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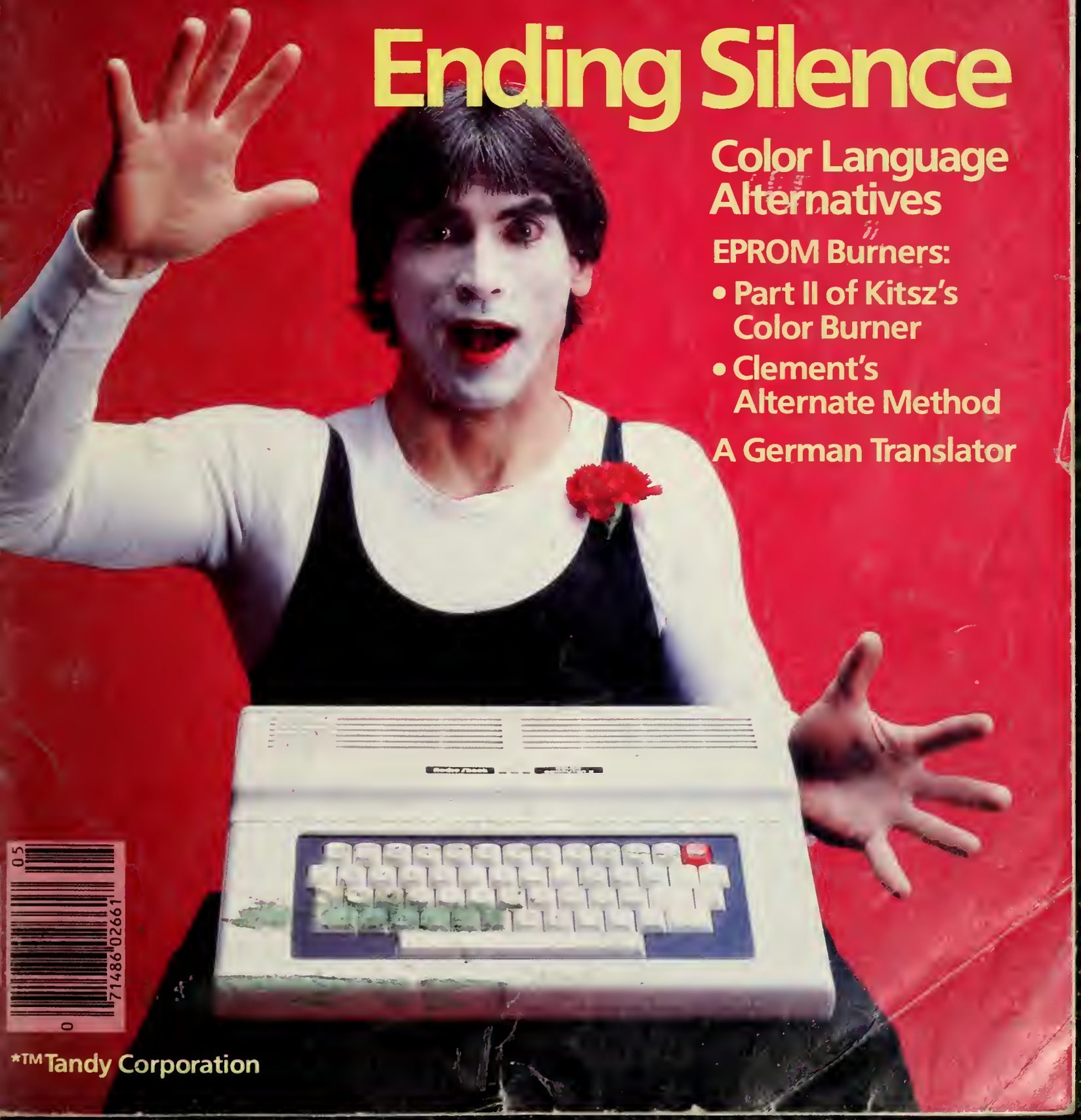

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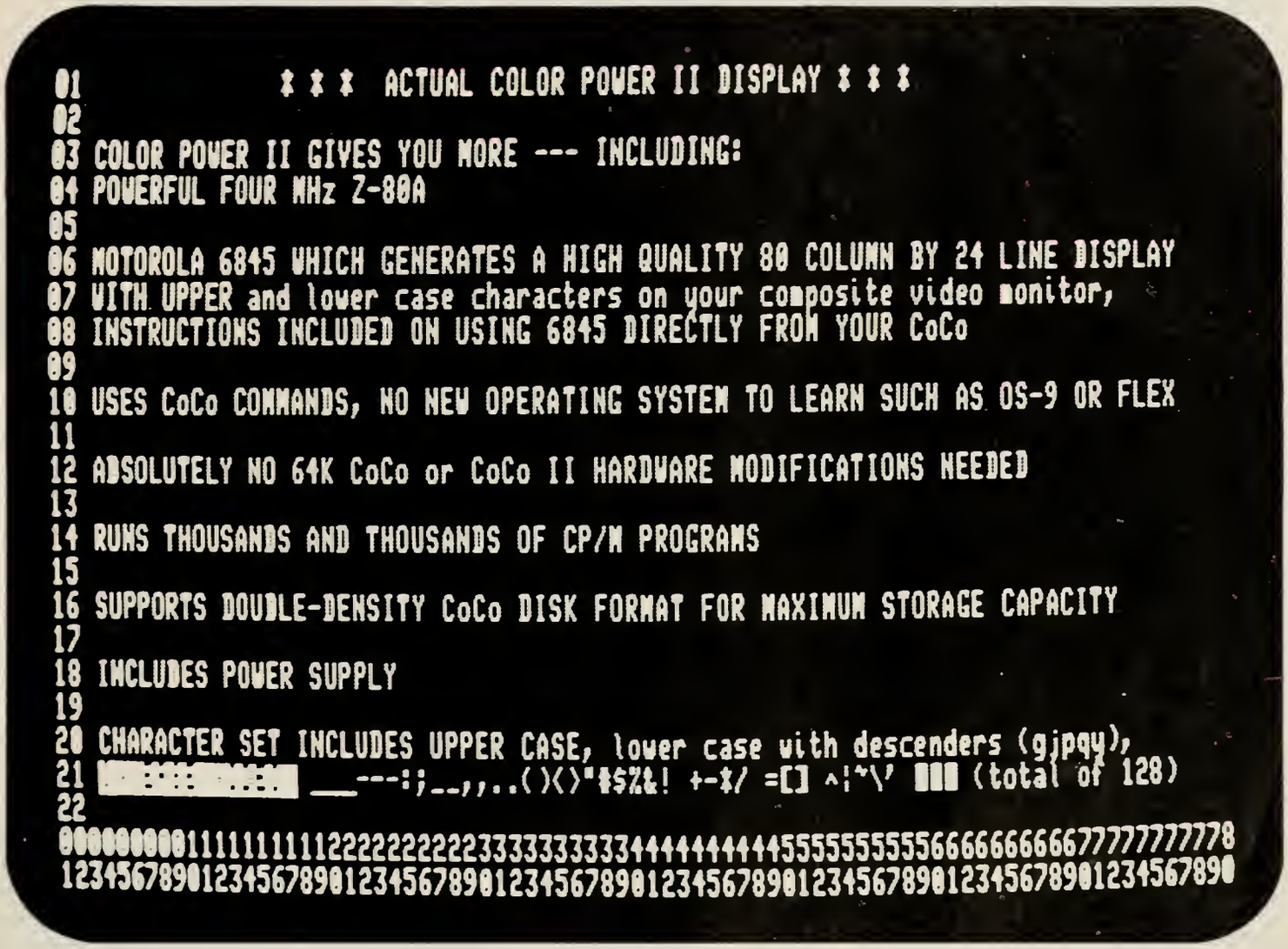

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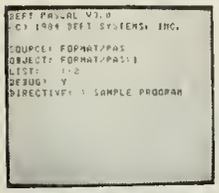

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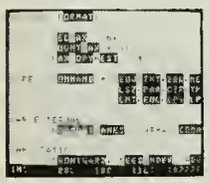

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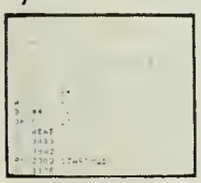

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Vol. 2, No. 3
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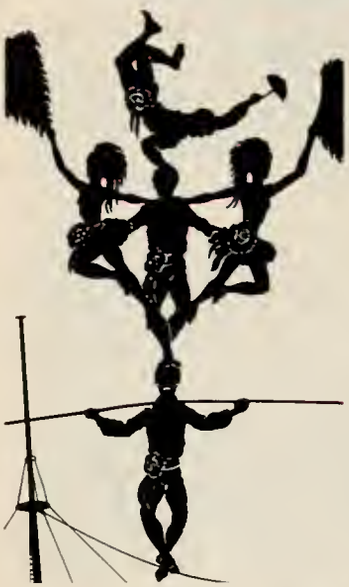
p. 74



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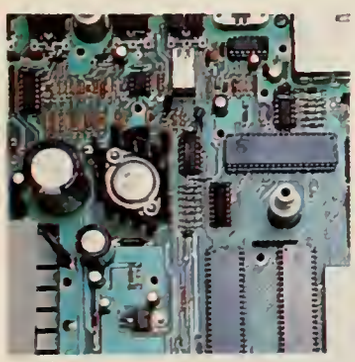

p. 100

p. 54

FEATURES

DEPARTMENTS

Cover *"A Loud Silence"* by Charley Freiberg. The mime on our cover and throughout the magazine is Sam Kilbourn — THE PANTO CLOWN of Freeport, Maine.

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PEEK (05,84)

May we look at microcomputer languages this month? Your Color Computer is capable of using several languages besides our old standbys, Basic and assembly language. In fact, it can use a handful of other languages, each with its own strengths and weaknesses. If you've never tried any "foreign" computer languages, you should make a point to do so — they will give you a perspective on Basic that you can't otherwise acquire. You may discover that Basic — that easiest of languages to use and learn — is neither so useful, nor easy to learn, nor *logical*, as another language that you have a particular affinity for!

Those of our readers who are new enough to computing to be surprised to hear that other computer languages exist should GOTO 68, to read all about what a computer language is. Mike Federle defines *compiled* and *interpreted*, *high-level* and *low-level*, and looks at some popular computer languages.

Now you know what compiled means, GOTO 77 for a review of a Color Basic compiler, then GOTO 81 for a review of a Pilot compiler. Hint for beginners — you need a compiler for the language you want to use before your Color Computer can work with that language.

GOTO 87 if you're ready to jump into C — Bob Jack explains C's structure and compares a C listing with a Basic listing.

GOTO 110 for a tour of Logo, that wonderful teaching language that captivates adults nearly as readily as it does children. Craig Dickenson, our local Logo expert, presents a fine view of Logo and shows us what some of his students have done with it.

Keep your eyes open in future issues for articles on Pascal, structured programming, and more!

For a foreign language article of a different kind, GOTO 20: "Wörte and Sätze" is a German language tutor.

On-Line is the new name for Terry Kepner's how-to series on CompuServe and Wayne Day's what's-up series on the Color Sig. With impeccable editorial style, we realized (five months later) that these should be parts of the same column. Hence, the new name. For this month's installment (Kepner, not Day), GOTO 12.

Finally Clement's alternate EPROM burner method, promised from March: GOTO 30.

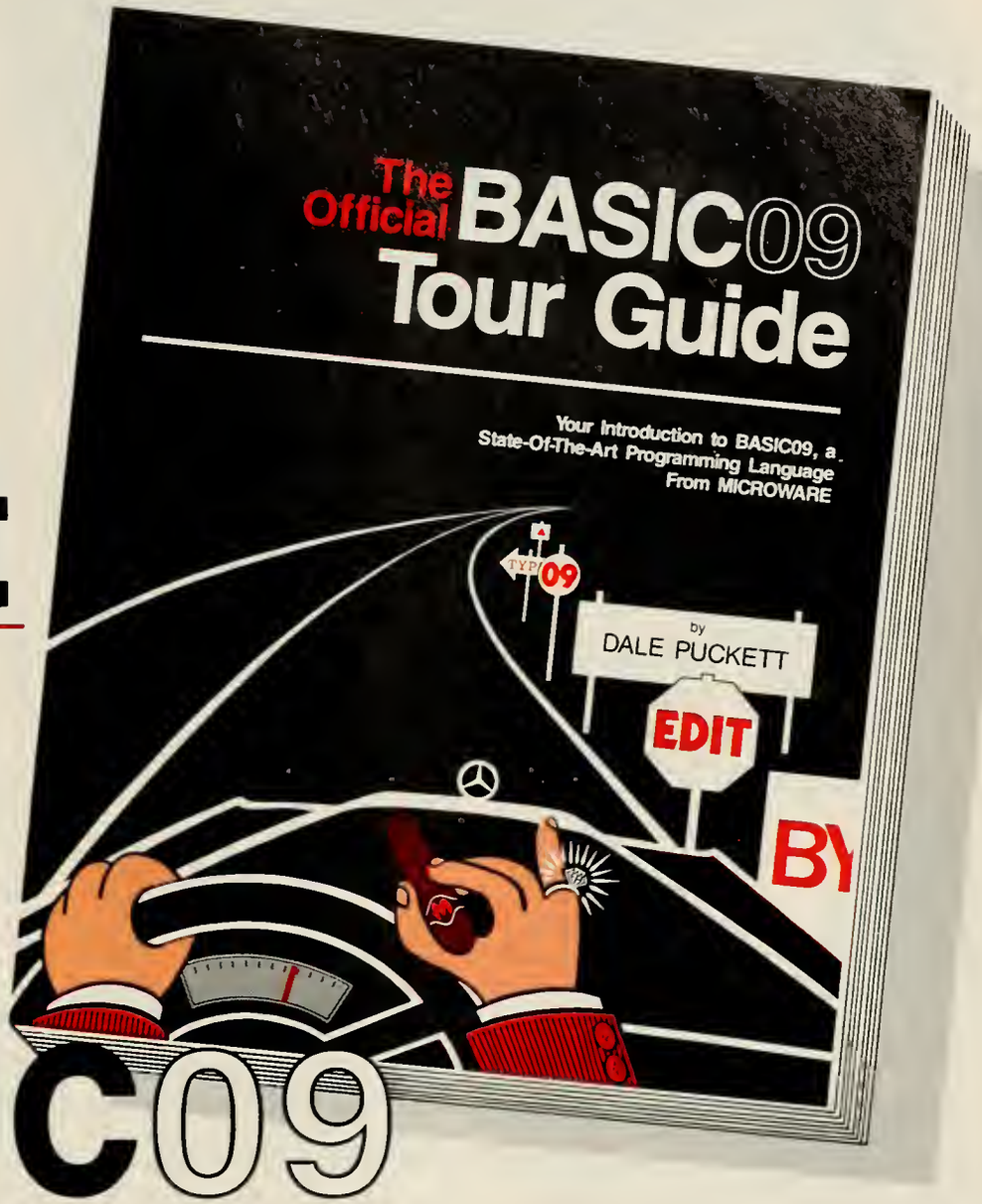
A note on continued articles: Really, folks, I don't split these things up just to see you cry. I split these things up only when I can't make 'em fit any other way. Dennis Kitsz's EPROM burner article, begun in March, continues this month (GOTO 54), and, I promise, will end next month. Really. And the second half of Devil's Disk Editor (Barden, April) *will* appear next month. I swear it. (You might say the devil made me skip it this month...) GOTO 100 for a series I haven't skipped for a while — Jake's disassembly. Finally, more summer project winners to come, even tho' they're absent this month!

Don't miss our regulars — GOTO School (GOTO 16), DEFUSR (GOTO 118), reviews and new products... It's a great issue!

Readers: some confusion concerning our program listings still exists. The up caret ^ that appears in listings represents the *up arrow key* — we use a printer that doesn't print an up arrow. Make a note of this!

— D.M., Editor

Get the most out of BASIC09



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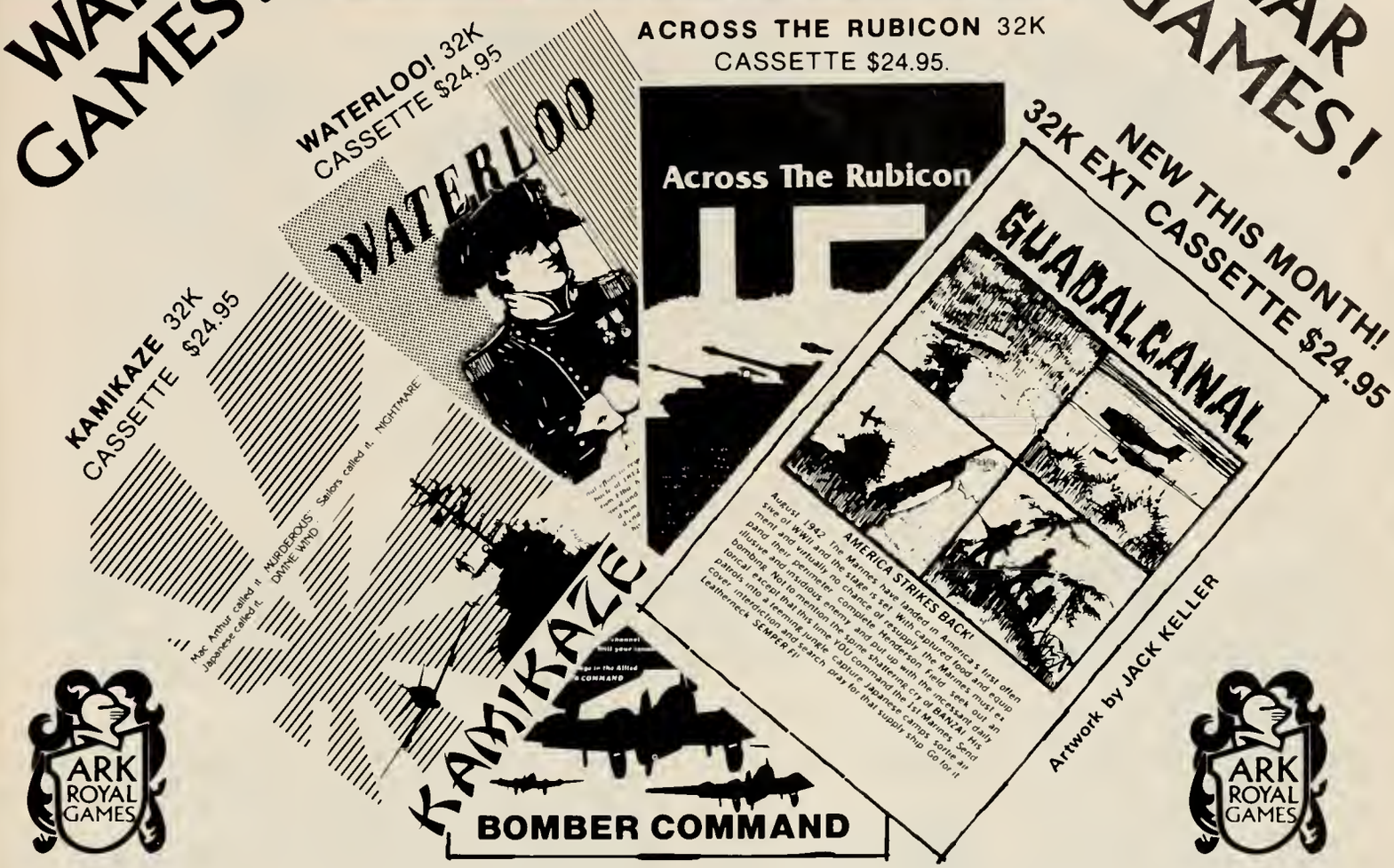

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INKEY$
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Dynacalc

I'd like to comment on the review (April, 1983) of our Dynacalc electronic spreadsheet program for the Color Computer running Flex.

We appreciate your reviewer's comments regarding the manual's lack of an index, but the table of contents should serve almost as well. We will, however, look into the feasibility of providing an index.

In the section of the review called "Screen Features" the problem of the "lost" cursor is mentioned. The relative obscurity of the cursor is an artifact of the Flex screen. In the "Commands" section is a description of the /AW command as an "attribute" and "window" command. That should be "attribute" and "width." In "Values and Expressions" is a negative comment on Dynacalc's lack of operator hierarchy. This is something we did deliberately for compatibility with existing VisiCalc models; this method of expression entry is more appropriate than the hierarchy used by typical computer languages because Dynacalc is designed for non-programmers. And in "Functions," the lack of logical functions is pointed out. All new versions of Dynacalc will include the logical functions @TRUE, @FALSE, @IF, @AND, @OR, @EOR, and others, plus a full complement of comparison operators. Finally, in the "Performance" section is a comment about the lack of actual scrolling. This is not the fault of either Dynacalc or Flex, but the hardware design of the Color Computer.

H. Joseph Turner, Jr.
President, Computer Systems Center
Chesterfield, MO

Keeping Track

As a reader of **The Color Computer Magazine** as well as other computer publications, I would like to make a suggestion to all who enter programs for their Color Computer. Enter a REM statement or two that will identify the publication and issue date. This comes in very handy when you wish to make reference to the original article which generated the program.

Harold L. Laroff
Monsey, NY

Recover Error

There is an error in the "Recover!" program (August 1983, p.66) of which readers should be aware. The utility will not work properly if the first line of the program has a line number of 0 (most likely), 256 or a multiple of 256. It crashes because the utility starts its search on the least significant byte of the two bytes which store the line number of the first line. To fix the problem, change the 35 in Line 200 of the Basic listing to 36, or change LEAX 3,4 in the source code Line 130 to LEAX 4,Y in the assembly version.

Jack Shaffer
Oakwood, IL

Pinched Tape I/O

Recently I noted the review of Softrol LSS-2 (June 1983). I noted that the reviewer had found a bug in saving and calling back. I'm glad to see that somebody else has had that problem (misery loves company).

Right now my Color Computer is fried so I cannot try out Softrol, but here are techniques that I have used in the past to overcome the "pinched tape" I/O. Most of my "pinched tape" I/Os came from tapes with data stored for processing. The lag time between input to the computer and moving to the next block would, after a few uses, cause this I/O. I started to incorporate tape movement in the following manner:

After each tape file is CLOSEd: (line number) MOTOR ON:FOR X = 1 TO 1000:NEXT: MOTOROFF. This will move the tape forward to put the printed data well inside the cassette. After each close from each read from tape: (line number) MOTOR ON:FOR X = 1 TO 500:NEXT:MOTOR OFF. This will move tape forward half as much as the print to the tape. The tape moves forward enough to be protected within the cassette and leaves the pinched area somewhere around the middle of the unused tape section.

When making several program saves on one tape: CSAVE"FILENAME":MOTORON:FOR X = 1 TO 1000:NEXT:CSAVE"FILE NAME":. Repeat this the number of times for desired number of saves.

When you're finished type

Clubs

WV/OH Club

A Color Computer users groups is forming in the Parkersburg, WV/Marietta, OH area. For more information contact: Gregory Wentzel, 1209 36th St., Parkersburg, WV 26104.

Concord, NC

A new Color Computer users group has formed in the Concord, NC area. For more information write Bradley Mabe, Rt. 1, Box 152A, Concord, NC 28025

New Mexico Club

Albuquerque Color Computer Club, a part of the New Mexico Computer Society, has reorganized and meets every other Tuesday at 7 p.m. for two to three hours. There are no dues unless you join the computer society itself, which we prefer long-time members do. For more information contact Steve Maggs at 293-8567 or Anthony Segura at 821-5876 in Albuquerque.

Alabama Users Group

Crazy Cursor's Computer Club officially opened December 29, 1983. Club membership fee is $5. Members get games at special savings. For more information write to Mike Staffs, 4624 Meadowlane Drive, Bessemer, AL 35023 or call (205) 424-0460 on Saturdays.

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MOTOROFF. This avoids having to stay with the computer when making multiple saves of a long program.

I have used the often overlooked MOTORON and MOTOROFF functions within the program or in the immediate mode to uniformly space out programs or data blocks on tape; it is useful to prevent "pinched tape" I/O errors.

By the way, a source of magnetic glitches on tapes and disks is the high intensity lamp that uses the 6 or 12 volt bulb. The transformer usually is in the base of the lamp and should it happen to be on a tape or . disk when turned on it can junk the program or data.

Charles H. Camp
Pineville, IA

More Fibonacci Fun

In response to K.H. Kossmann's INKEY$ letter (February, 1984), here is another approach to the Fibonacci sequence.

```
10 CLS:N1=1
20 N=N+N1:PRINT
N1;N;:N1=N1+N:GOTO20
```

Don Lockwood
Washington, PA

More Assembly Language?

Keep up the outstanding quality. I get all the major computer publications (I think) including Dragon User (published here in the UK) and **The Color Computer Magazine** is head and shoulders above the rest.

One suggestion for future issues is a bit more on assembly language programming. If other Color Computer users are like me (having owned mine for three years) Basic no longer satisfies our needs. Also, now that Bill Barden has an assembly language book out, the interest in this aspect of programming should increase.

Charles S. Nichols
FPO, NY

RX Management Fix

In the article "RX Management" (February, 1984) there appeared four photos of screens from the program. The format is confusing in that the entries are longer than the column titles at the top of the screen allow. The article states that the name of the family member should not exceed eight letters and that the date should be entered in the MM/DD format. Actually, the name should not exceed seven letters and the service entry should not exceed eight. A properly entered medical record should look like Figure 1.

As the program is now, if one wants to return to screen viewing after printing it is impossible to do so once the print statement is initialized to PRINT #–2. This may be corrected by changes to the following lines:

```
80 CLS:P=0
1610 I=I-1:Z=1:GOTO 80
```

John Duling
Las Cruces, NM

MEDICAL RECORDS 1982

NAME	DATE	SERVICE	AMOUNT
1 GEORGE	07/18	FINGER	$ 89.90
2 MARY	06/04	STOMACH	$283.95
TOTAL SPENT:			$373.85
INSURANCE REC'D:			$135.40
BALANCE:			$238.45

FIX (03,84)

Those of you having problems with the cashbook program should replace Lines 4050 – 4070 with the lines shown below:

```
4050 WRITE#1,C1,C2,CC,N$:FORL=1T
O CC
4060 WRITE#1,B1$(L),B2$(L),B3$(L
),B4(L):NEXTL
4070 FORL=1TOC1:WRITE#1,SA$(L),A
C$(L):NEXTL
```

Bulletin Boards

Modem Link BBS

Modem Link BBS is available 24 hours a day, 7 days a week. Modems should be configured to 300 baud, 8 bit word. Answer the ID prompt with ML. The password is MAG 1. Call (914)358-6840.

Westchester BBS

Westchester BBS, a new bulletin board service, will be online 24 hours a day, 7 days a week. Downloads, uploads, as well as graphics are supported on the board for those that have the right software (Color Com/E or Videotex) for the graphics part of the board. Nine hundred and fifty never-before-published programs will be put on the download section as time goes by. The programs range from simple 4K Color Computer to full-blown 64K two disk drive business programs. All are free!!!

For more information call (914)632-1840, or write: Westchester BBS, Bill Graspo (Sysop), 10 Davenport Ave., New Rochelle, NY 10805.

More Bytes

I have found a quick and easy way to obtain 31215 bytes of memory in a 32K computer. Type in POKE 25,6:NEW then type CLEAR0.

John Sniegowski
Scranton, PA

Generic Tests

I would like to make a few comments on my article, "Generic Tests" (January, 1984). The article is a little unclear. Listing 2 is the listing being explained in detail and will run on a 16K Color Computer since it was developed on one. Listing 1 should run on a 4K Color Computer but I have not tested it since I do not have access to one. As the article states, the program was developed some time ago. If I were to write it today, I would make a few changes.

For instance, if you have a 16K Color Computer, you can create large lists of questions using the DIM command. To do so, here is the list of changes: Take out LIMIT 10 in Line 15. Change Line 18 to IF A < 11 THEN 21. Add Line 19 IF QZ = 1 THEN 21. Add Line 20 DIM A$(A),D$(A):QZ = 1. Add Line 88 IF A < 11 OR QZ = 1 THEN 90. Add Line 89 DIM A$(A),D$(D):QZ = 1.

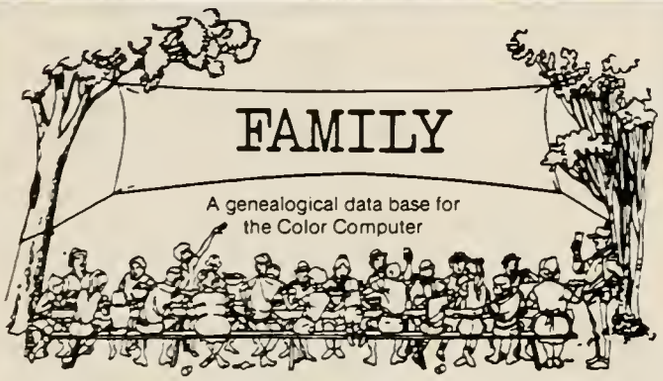
You can now create lists of just about any size. You can also use different size lists without having to end and rerun the program. Just remember, the first time you enter a list of questions the number you put in will be the limit for lists that come after.

The G$(G) in Lines 165 and 168 would have to be changed to G$ if you want to use lists larger than 10.

Listing 1 should be adaptable for the MC-10. Lines 156, 168 and 174 would have to be rewritten to eliminate the Else command. You might want to adopt some version of the changes listed above. Since the MC-10 handles dimension data a little differently, and has a little more memory that the 4K Color Computer, I cannot say what other changes should be made.

Robert Toscani
Philadelphia, PA

PETROCCI FREELANCE ASSOCIATES



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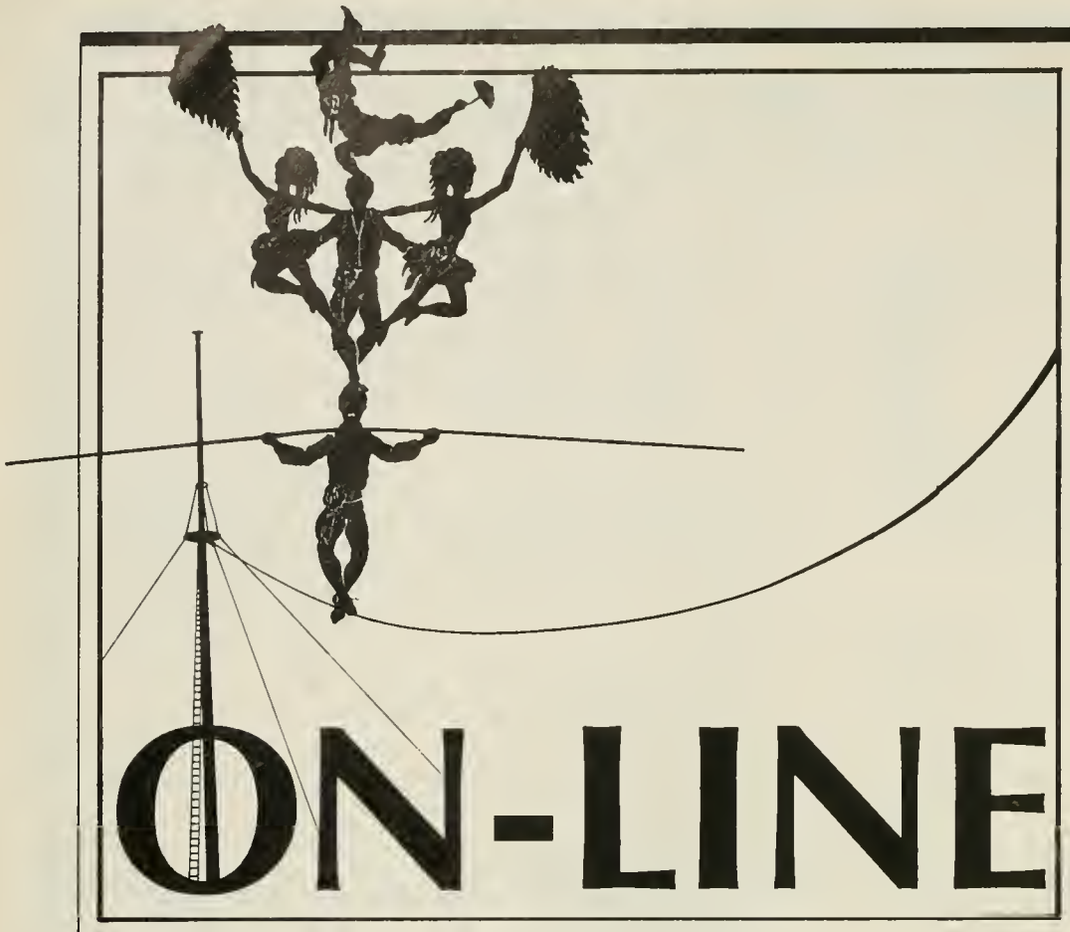

ON-LINE

by Terry Kepner

WE'VE LOOKED AT two major sections of the CompuServe system: the bulletin board system and the conferencing mode. Still left unexplored are the databases, sometimes referred to as CompuServe's "basement." The databases are divided into the user interest database (V), and the XA program and file database.

The user interest database is useful for finding people with similar interests, for finding computerists in your locality, or as a simple membership list that's updated by members themselves. The setup is simple: from the Function prompt, type V. Now you can add an entry to the database with A. Entries consist of your name, address, and any interests or facts you want others to know. You can change an existing entry with C; delete an existing entry with D; search the database with S; or return to the function prompt in the main SIG with T.

More fun, however, is in the XA databases which are huge, with dozens of programs in each section. The XA database is subdivided into eleven sections, each linked to a BBS section number. (Thus, if non-members are prevented from seeing messages in section 6 of CompuServe, they are also prevented from accessing XA database number six, as well as conference channels 6 and 16.)

Programs range from cute (a program that plays the "Star Wars" theme music) to highly technical (an assembly language sort). All files in the XA databases have been submitted by members, for members. Any member can download these files and use them as he or she feels fit. However, as a courtesy, if you modify a program and leave it for others, credit the original writer of the program in the opening remark statements. You can't use these programs for profit or commercial purposes without running afoul of copyright laws; while the programs are available to CompuServe SIG members, they aren't public domain programs unless the authors specifically release them.

To get to the databases, type XA at any Function: prompt. The system will then ask which database you want, numerically listing those available. For slightly faster results combine the commands like this: XA 5. The space between XA and the database number is required. The database number and its section heading are then listed; for example: XA1 — General News. This doesn't *describe* the database, it just tells you with which SIG section it's associated. If you decide you're in the wrong database, type XA n to switch to a new database (n should be replaced by the target database's number).

Once in the database the Scan, Browse, or Catalog commands (S, BRO, or CAT) are used to list all programs available. The S and CAT commands may not be too helpful, however, since they only list the program names, author PPNs (user ID numbers), dates of submission, and byte sizes of the programs. For more information use the key options with these commands.

(The Scan and Browse commands are essentially the same as the CAT command, except that Scan is two letters shorter, and Browse automatically pauses after each program description so you may read the program, download the program, kill the program (if it's your program), return to the top, or continue to the next program in the database.)

Using Key Options

The key option is a more selective method of identifying programs with the CAT command in particular. The first key option is for description: by typing CAT /DES you'll get a list of all programs in the database, with search keywords listed and authors' descriptions of the programs, in addition to the authors' PPNs program names, submission dates, and byte sizes.

If you want a list of new programs rather than a reprint of information you received last time you used the database, use the /AGE:N option. Typing CAT /DES/AGE:30 will list all programs submitted within the last 30 days.

If you want to see only game or graphic programs use the /KEY:list option. Typing CAT /KEY:GAME will list all programs containing "game" in their search keyword list. How do you know which keywords to search for? Just type KEY at the XA prompt for a list of the keywords in use (these are updated as necessary).

To search for programs using several keywords, use the commands + and & for logical OR and AND functions. For example: CAT/KEY:GAME&GRAPHIC would list only the programs containing *both* GAME and GRAPHIC as their keywords. CAT/KEY:GAME+GRAPHIC would list those programs with *either* GAME or GRAPHIC or both as a keyword. A command keyword list may be chained together up to the maximum CompuServe line size of 80 characters.

The usefulness of the /KEY:list command can be increased by using "wildcard" characters for category matching.

The two wildcards are * and ?. The asterisk is used for groups of letters, and the question mark is used for specific letters. CAT/KEY:*xy searches for any keyword ending in the two letters you type to replace *xy*; CAT/KEY:*xy* searches for keywords with the two letters *xy* in the middle; and CAT/KEY:xy* searches for keywords starting with *xy*. Finally, CAT/KEY:x?yz searches for a four letter keyword starting with *x*, ending in *yz*, with any letter or number in the second position.

When you use the keyword search, you will discover that some authors leave off keywords or don't check to see which keywords are already in use when they assign keywords to their program. For example, they may use "hi-resolution graphics" instead of "two-color graphics," "Color Computer" instead of "CoCo," and so on.

The final key option for the CAT command is /PAUSE, which stops the catalog command after each program description; press Enter to continue.

To set the description of a specific program, type CAT filename.ext. If you're unsure of the file name, use the wildcard characters described above between the file name and extension. Thus, CAT *.REM would list all programs whose extensions are REM.

If you are searching for programs by a particular author, type his PPN number with the search commands and only his programs will be listed: CAT[70615,1357] (the brackets are required) would list all my programs in that database, if I had any there.

Downloading

Once you've found a program you like, there are two ways to get it into your computer: DOW and TYP. Both commands send the file as an ASCII file.

Dow requires that you use one of the three most common methods of file transfer: ^R/ ^T (CHR$(18)/CHR$(20)), automatic buffer capture; CompuServe A protocol; and CompuServe B protocol.

The first method is the most common method. CompuServe sends you a control R, opening the receive buffer in your computer, then sends the file. CompuServe then sends a control T to close your receive buffer. The other two protocols use different control characters.

To use TYP to download a program or file you must manually open your capture buffer and tell the SIG database when you're ready to list the program into your computer. As CompuServe sends the file, your software automatically saves the incoming characters. When the file transfer is completed, CompuServe sends the database prompt and waits for your response. Close your buffer and save the program or file to tape or disk. The disadvantage to this approach is that you often have the command TYP filename.ext and the database prompt as the first and last lines in your newly received file, which you'll have to edit out later.

Uploading

To contribute your own efforts to the program pool, save your programming gem as an ASCII file. You now have two choices. (Since the SIG software is in the process of being updated and improved, not all SIGs will accept both methods.) The first method works on all versions of

the SIGs and is the most time-consuming:

1. Load your terminal program, then load the ASCII program or file you want to submit into your terminal buffer.
2. Log onto CompuServe.
3. From the CIS prompt ! type EXI, or MIC, or GO PCS60. This puts you in the personal programming area of CompuServe.
4. At the OK prompt type FIL filename.extension, with the appropriate file name and extension you want to use (file name — six characters maximum, extension — three characters maximum). All alphabetic characters (upper and lowercase) and the numerals zero to nine are legal.
5. CompuServe will respond with: New File FILE.EXT created— Proceed.
6. Now upload (send) your file.
7. When you've finished uploading, signal that you're done by typing / EX (note: all Filge editor commands are indicated by a slash in the first position of a line, so be careful to avoid starting lines in your program or file with slashes).
8. At the OK prompt, type R ACCESS or GO ACCESS to get to the public access database.
9. At the Access: prompt, type SUB filename.ext. The file name extension must match that used in your personal programming area when uploading the file.
10. Next you'll be given a copyright warning and asked if the file is to be visible or invisible. Whichever you want to use is fine. If you assign the file as visible, you will be prompted for keywords you want assigned to it (you should check which keywords are in use before you start to submit a program or file) and then for the file's description (500 characters maximum). You must use all alphabetic characters (upper- and lowercase), the numerals zero to nine, and these special characters: plus sign +, minus sign –, number sign #, dollar sign $, period ., and underline. The special characters are *not* to be used to separate keywords; for the sake of convention, use spaces or commas. In general, the keyword list should be descriptive of the file's content, not a title. To indicate you're finished, send a blank line (one carriage return to terminate the line, a second to indicate you're through entering text).
11. You'll be told when the file has been copied to Access holding area.
12. Type EXI.
13. At the OK prompt, type R DISPLA to go back to CIS–1.
14. Wait 24 hours for CompuServe to put your file in Public Access.
15. The next day, go to the SIG. At the SIG prompt type XA.
16. When prompted, give the destination database.
17. At the database prompt, enter SUB filname.ext (must be the same as the name you used in the Public Access area). If you assigned the file invisible status in the Public Access area, you'll now be prompted for the file's keyword and description, since all SIG files are visible.
18. After your file is copied to the SIG holding area, type EXI to return to the SIG Function prompt.
19. Leave a message to the SYSOP and everyone else that you've submitted a file to the SIG database.

CompuServe won't let you send more than 144 characters in a program line without locking everything up. If you're using Tymnet to access CompuServe, the line limit is 128 characters. If you experience trouble in uploading, the problem might be line length (remember, ASCII text lines are longer than their tokenized versions). If your software has the option, set it to send a carriage return every 128 characters. (You'll only be able to send 128 characters per line in your program description without a carriage return, also.) Or better yet, write your program with line lengths below that limit.

The other method for submitting files is much easier, although the same line limits apply. Unfortunately, only the latest versions of the SIG software (version 2C(9)) will let you use this method.

With your terminal software and ASCII file prepared, sign-on to CompuServe and go to the SIG and its appropriate database. From the database prompt, type UPL filename.ext (the same name restrictions apply in this method of submitting files as in the other). You'll be prompted for the file's keyword list and its description. Now upload the file. When you're finished leave a message in the BBS section to the SYSOP, telling him about the new program.

Errors?

If you discover an error that requires the program's removal, use the KIL, DEL, or ERA commands (kill, delete or erase) to delete the file. If you decide the keywords are wrong, or that the description is misleading, you can change them with the CHA (change) command. The CHA command lets you retype both the file's keyword list and its description. (Both the erase and change functions will work only on programs and files *you've* submitted to the SIG.)

Occasionally you may want to examine the Public Access database. Rather than exiting the SIG, going to Access, then returning to the SIG, you can jump directly to Public Access by typing PUB at any SIG database prompt. When you're finished with the Public database, NOR will return you to the SIG database. Because the SIG databases are actually just subsets of the Public Access database, all the commands discussed in this article (CAT, KEY, etc.) work in both sections.

Like the rest of CompuServe, the database section makes assumptions about how you've set up your computer. It defaults to full prompts, menu mode, and pausing when one screen of information has been sent (BRIEF, MENU, and PAUSE). If you want to change these, use the Set command with the appropriate option: NO BRIEF shortens prompts; NO MENU eliminates the menus; and NO PAUSE allows screen non-stop scrolling. If you want to check your settings, type SET and current settings will be listed.

The final commands work in the main SIG and in the databases: UST, SEN, OFF, and BYE. Off and Bye log you off the CompuServe system. If you want to return to the main SIG, type EXI. The other two commands are a bit more exotic. UST will give you a list of all the users currently in the SIG. This list will give you the PPN, job number, section of the SIG, and input node used by each current on-line user.

The SEN command lets you send someone a message. Include the job number or node name: SEN JOB ### message; SEN ### message; or SEN nnnnnn;message, where *###* is the job number and *nnnnnn* is the name of their input node. The length of the message is limited to one display line, as set by your terminal defaults. Now, just because you sent someone a message doesn't mean they received it: if they were in the middle of a download or upload, the system has enough sense to know better than to interrupt. If your message isn't delivered, you should receive an error message telling you the message didn't make it.

That concludes this month's excursion into the mystery of CompuServe. ■ ■ ■

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53,000 character buffer (64K).
Split buffer option (64K).
10 macro keys.
Four buffer send modes (dump, prompted, manual & time delay).
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Scroll forward & reverse to view buffer & print viewed screen option.
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GOTO SCHOOL

by Dr. Paul Kimmelman

THIS MONTH I WILL give answers to some of the most common questions I get from readers. I encourage you to feel free to add to my responses or take exception if necessary; a question-and-answer session will be appearing from time to time.

Why buy the Color Computer instead of Apple? I wish I had one dollar for every time I have been asked this question; I'll bet I could have installed at least one complete Color Computer lab in our schools by now with that money. I have found that arguing over brands of computers is like trying to calmly discuss politics and religion. I believe there are many solid reasons to purchase the Color Computer.

First, it is economical. It is still possible to put together a 32K Color Computer station for under $500. The price gets better if you are eligible for the 20 percent educational discount.

Second, the Color Computer is supported by the Radio Shack dealer network. Translated, that means dealer support, service, and dependability. Where are the Texas Instruments computer owners going with their problems now? Not much of a bargain, even at $59.

Finally, Radio Shack has an education division devoted solely to the educational applications of their computers. The division, headed by Bill Gattis, is constantly seeking ways to improve or expand use of the Color Computer. Granted, the division moved at a snail's pace several years ago, frustrating Color Computer owners, but in the last year the snail has been more like a rocket. New manuals, peripherals, computers, and software have all solidified the Color Computer's position in the education market.

How can I convince my superintendent that the Color Computer is a "best buy?" I usually get this question from an enthusiastic Color Computer owner who wants to get Color Computers in the schools — not an easy task in many instances. Don't try to defend a Color Computer purchase for schools with an emotional plea — look instead for specific criteria that meet your educational needs.

Most schools seek economy in their purchases. Be sure to price an entire system, i.e., computer, television or monitor, cables, disk drive or cassette recorder, joysticks, and covers. Try to make your comparisons as equal as possible — color television or monitor, memory, etc.

It is often astounding to find out that once a complete system is put together how much more one computer station can cost over another. When confronting your superintendent, be sure to have these comparisons.

Look at a system that meets your educational needs and be specific as to how it supports those needs. It may be nice to say you have a 64K machine, but is it necessary? Do you need disk capability or will tape suffice, at a major cost savings?

Support your position with exemplary software. If computer assisted instruction is the main application your school will use, then demonstrate the existing software that fulfills your objective. *Demonstrate* is the key word. Don't rely on a flashy catalog to support your claim that software exists that meets your needs. Far too often I hear people being complimentary of programs they only heard about or saw in an advertisement. While there is excellent software available for the Color Computer, like all other computers some of the software available for it is worthless.

The teacher who can put together a Color Computer system for his/her superintendent, along with a software presentation, will be making a persuasive case for its purchase.

Finally, this magazine has devoted itself to education and the Color Computer. Reviews are written by qualified educators looking for educational applications of software. Don't hesitate to use the reviews and articles to support your presentation of how the Color Computer and education interface.

How do we get started? Computer users, like folks playing the stock market,

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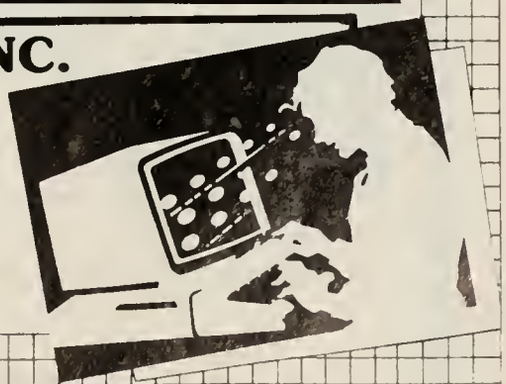


☎ Enter 26 on TeleResponse page 134

feel it would be great to get rich quickly, but that isn't the way it usually happens. Unless you have plenty of money it will be necessary to start slowly.

If you have only enough money to buy one station for your school you must review your objectives and requirements. For example, if you don't have three flights of stairs to travel between classrooms, you may want to purchase a mobile cart and roll the computer system to the rooms where it will be used. Don't forget those adapters for your plugs, and a safe extension cord! Remember that many of our schools were built long before computers became a necessary part of the curriculum and consequently electrical outlets are either too few or inadequate.

With only one computer, your choice of application will be limited. If you only want it to learn to program, you won't need software. You *will* need disks or tapes to save programs, however.

If computer assisted instruction (CAI) is your plan, quality software is important because the amount of time anyone can use the computer will be limited. There is some fine software available for math, spelling, social studies, and some other language arts areas (such as composition via word processing).

You should stick to your purchasing plan as the quantity of computers you can purchase increases. Once you have begun your computer plan, follow your objectives closely. Don't spread your plan too thin and fail to do an adequate job on the basics.

What should our computer program consist of? I think that there are four basic categories for a computer program: languages, applications, computer assisted instruction, and a catch-all for such topics as ethics, social responsibility, etc.

Computer assisted instruction is probably the easiest category to implement; you need only select a topic and find software that meets your need. CAI is a valuable tool for school use, but like most fun activities, too much could become counterproductive.

Programming is an important part of computer education. In addition to Basic, Logo and Pascal should be considered when writing the curriculum. Both languages are available for Color Computer users.

I believe applications are essential to any meaningful computer curriculum. Students should be instructed on how to use a word processor, what types of decisions can be made using a spreadsheet, how to maintain a file of information, home management through computer use, and the use of databases via telephone and modem.

There is little doubt that CAI and programming each fill a part of the computer curriculum basket, but students must know how to use their computers as a tool for everyday work. Word processors have been developed for young children, and there are the very sophisticated word processing programs available for use in high school secretarial training programs. Being able to ask "what if" through the use of an electronic spreadsheet would be helpful to students, especially those in business management education. While home economics as we originally knew the concept in an agrarian society has changed, the knowledge of home management through the computer could revive the home economic curriculum. Finally, the database has been featured in several articles I have written in this column.

These applications are "real" and readily available for Color Computer users. As a matter of fact, they can all be assembled in a Radio Shack Computer

Center store — meaning the equipment and software would be all Radio Shack brand. For those preferring *third party* (manufactured by companies not connected to the computer manufacturer) equipment and software, that opportunity is available as well.

What textbooks do you recommend for Color Computer users? The least expensive route to take for textbook selection is the manual included with each computer. Radio Shack's manuals are well written and easily read.

For educators working with Logo, teachers' manuals are available from Radio Shack. Included with the teacher's manuals are pages that can be copied and used for student worksheets. A book for parents on Logo is also available from Radio Shack.

There are several other books available for Color Computer users. Again, use caution before purchasing a book. Make sure you have reviewed the contents. Is it suitable for your classroom? Is the reading level appropriate?

What software should we purchase? This question poses an article in itself. There are many programs available for Color Computer users. To simplify the problem, it is essential to narrowly establish what your plans are for the use of the computer.

I cannot overemphasize the importance of reviewing a program before its purchase. At the very least, be sure you can return software with which you are unhappy.

Another suggestion would be to carefully read magazine reviews. Does the program appear to meet your objectives? Will it run on your computer — what memory is needed, disk or tape, etc.?

Should I purchase a monitor or television? I wish Radio Shack had made it possible to connect the Color Computer directly to a monitor. The advantages of using a monitor are persuasive: no more RF interference. Unfortunately, to use a monitor it is necessary to open your computer, a task Radio Shack does not look kindly upon for those under warranty. *Don't* use a cable until your warranty has expired. There are several cables available to interface a Color Computer with a monitor.

Those who are satisfied with a television have unlimited options. I have observed success with equipment as varied as a 13-inch $179 TV, to Radio Shack's television selling for $399.

TV or monitor, the decision is up to the user. If economics are not a problem, I suggest the monitor.

My superintendent says computers aren't necessary! When his head comes out of the sand, ask him to read any recognized education journal, take him to the nearest magazine rack, or open the daily newspaper — it usually includes a story about computers and education.

The world is always full of doubters, but computers aren't a fad. They have a realistic place in the educational plan when used properly. Don't lose your job over your superintendent's opinion — the public will take care of the problem for you.

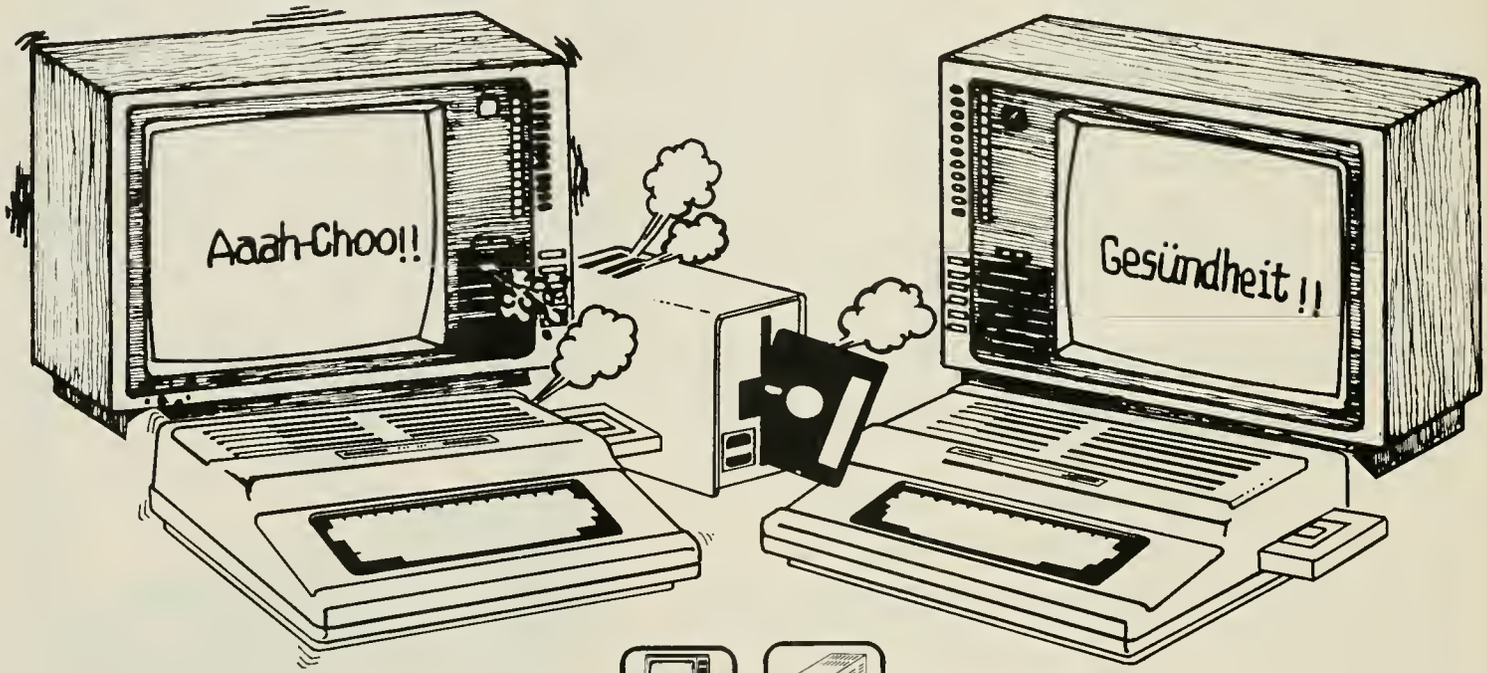
The Color Computer can be a real asset to a computer curriculum plan. It is economical, expandable, well-supported by both its manufacturer and third party companies, and reliable. There is an abundance of software available for a whole host of educational applications. New books for Color Computer users are regularly published on many topics.

But don't argue with those who don't believe the Color Computer is a good computer. Put a system together and start running the programs that support your claims. ■ ■ ■

☎ Enter 29 on TeleResponse page 134

WÖRTE & SÄTZE

A German tutor for kids or adults.



32K Disk Basic

by Bob Jack

MOVE OVER BERLITZ, Worte and Satze is here. The Worte and Satze program is designed to teach basic German through random drilling in either English or German.

For The Programmer

Good programs are programs that are written as simply as possible. If you pick up a program written six months ago you should be able to quickly read and understand it.

This program is fairly straightforward and easy to use. Explanations are given in the "Program Set-Up" and "Teaching Others" sections. Some of the subroutines have multiple applications, done to shorten the program.

The program becomes easier to use if you remember that the sole purpose of the Words Sentence subroutine is to set the L series of control variables. The control variables then set the way the other routines address the disk files. Table 1, a line oriented program description, and Table 2, a variable description, will also help you.

Another Language

To use the program with another language change Lines 240, 250, and 260. These are the N series of string variables. N1$ is the disk word file, N2$ is the disk sentence file and N3$ is the language name. While it is only necessary to change N3$ to use the program with another language, it is a good idea to change N1$ and N2$ so you will easily recognize the disk files.

Special Note

The portion of the disk file which deals with pronunciation can be routed to a

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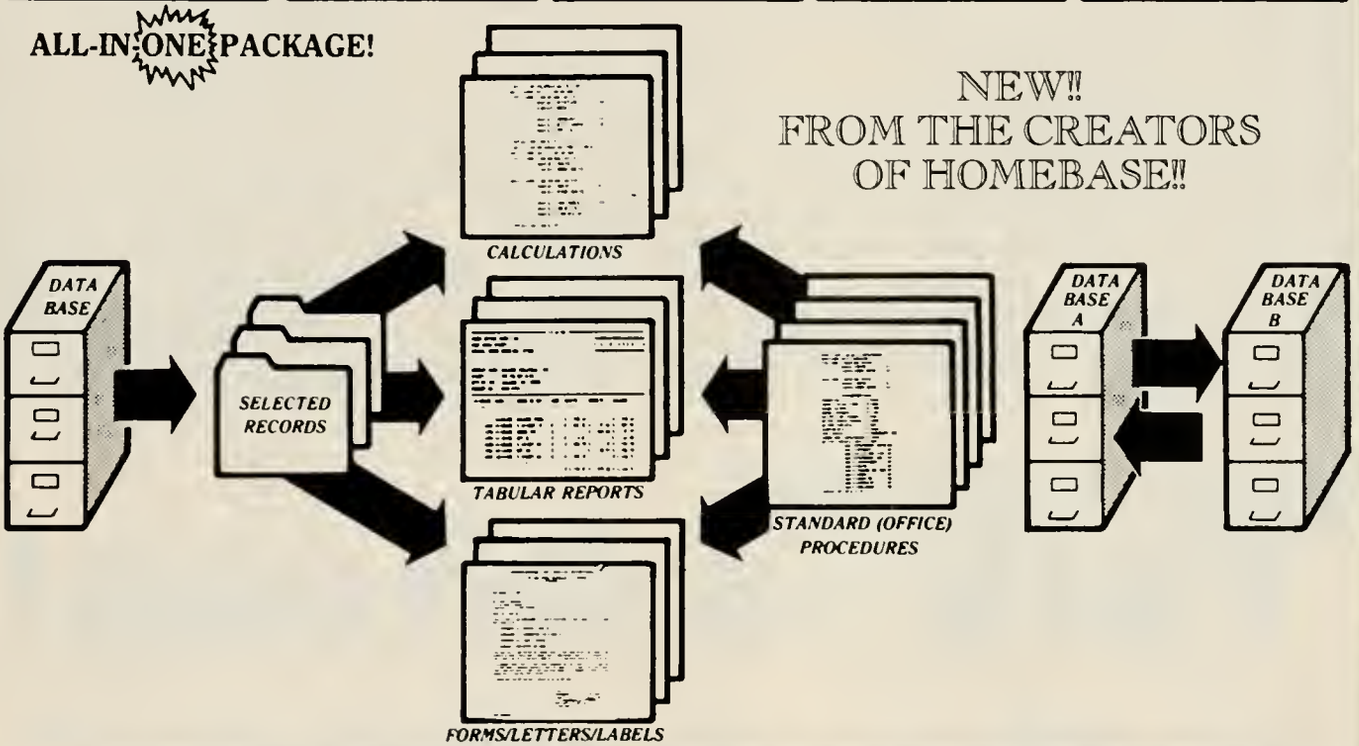

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speech synthesizer, thus creating a super program for learning a foreign language.

Program Set-Up

In learning any language there are three levels of comprehension. At the "passive" level the student is able to translate a foreign language into English. At the "active" level the student is able to translate English into a foreign language. The most difficult level is "cognitive," or thinking in the language. That's what is known as going native. This program addresses the first two levels. The student can drill in German which is passive and English which is active. Passive is the easiest to learn and is the basis of learning any foreign language.

Before using the drills, disk files must be set up. This is done by running the program, answering two questions about the current hour and minute (used to set up the random function), and selecting the Enter mode from the main menu. At this point, a sub-menu will appear asking if you want words or sentences: start with words.

What type of words should you enter? Since we are teaching beginning German, we used a dictionary in the back of a children's book on German. In this book we found a translation of English, German, and the pronunciations. To begin enter about 15 words for each letter of the alphabet. We included pronunciation keys only on the really tough words. After we mastered this list we added words from an advanced book.

Next follow the prompts back to the sub-menu and do the same thing for sentences. Books written in different levels of German can be borrowed from your local library.

It may seem like a lot of work to set up disk files, but it is the real strength of the program. You can set up the disk files at a beginning level and in a general pattern as shown above; or for teachers, at an advanced level, or in a specific pattern (verb conjugation, etc.).

Teaching Others

You will find if you are teaching the language to others that the single most important factor for success is having your students' attention. We found that contests between students helped. We varied the methods of competition. The adults competed against the children at times. One adult and one child competed against another adult and child at other times.

A good place to begin teaching is with passive word drills. Later, add the passive sentences. After the students have a grasp of the passive, start to drill the active words, and then drill sentences.

Listing begins page 24 ■ ■ ■

Table 2. Variable List

Variable	Description
AW	Numeric input
AW$	Alphabetic input
A$	Disk I/O for English
A1$	English storage
B$	Disk I/O for German
B1$	German storage
C$	Disk I/O for pronunciation
C1$	Pronunciation storage
CT	Count variable
L1	Control variable — length of English
L2	Control variable — length of German
L3	Control variable — length of pronunciation
L4	Control variable — length of current disk file
L4$	Control string — name of current disk file
L5	Control variable — number of records in current disk file
N1$	Disk file name for words
N2$	Disk file name for sentences

☎ Enter 6 on TeleResponse page 159

Table 1. Line By Line

Line Number	Description
10–60	**Identification**: Program identification, etc.
70–80	**Initialization**: Program initialization.
90–230	**Randomization**: Uses the hour and the minute of the day to set the random function.
240–260	**Name Set-Up**: Disk file and language name set-up. Note: change this section if the program is used for a different language.
270–310	**Disk File Initialization**: Opening and/or creation of disk files to get number of records in the file.
320–440	**Main Menu**: Main menu and program distribution. Note: 320 is the main re-entry point. Also note: No error trapping for active or passive drill without any words or sentences in the disk files. If this happens the program will halt with a disk error.
450	**End**: Fall through to program end. Ensures that all files are closed, clears screen, and ends program.
460–700	**Passive Drill**: The sub-menu first uses the Words Sentences subroutine to find out if you want words, sentences, or to return to the main menu. Next the display sequence uses the Get Random subroutine to get a word or sentence. It then displays the word or sentence in German with the option to branch to the sub-menu entry point or GOSUB to the Change subroutine. Next it displays the English word or sentence with the same options. Finally it branches back to the display entry point to restart the display sequence. Note: 460 is the main entry point and sub-menu entry point. 470 is the exit point. 490 is the display entry point.
710–950	**Active Drill**: Functionally identical to the Passive Drill, except English is displayed first. Note: 710 is the main entry point and sub-menu entry point. 720 is the exit point. 740 is the display entry point.
960–1280	**Enter**: The sub-menu routine uses the Word Sentence subroutine to find out if you want words, sentences, or to return to the main menu. The Enter routine then asks for an English word, checks for proper length, and gives you the option to return to the sub-menu. It then does the same thing for German and pronunication. Finally, the record is placed at the top of the disk file. It then loops back to the beginning of the Enter routine to begin the sequence again. Note: 960 is the main entry point and sub-menu entry point. 970 is the exit point. 980 is the enter entry point.
1290–1380	**Get Random**: Produces a random number in the range of the disk file length. It then gets the record and returns.
1390–1500	**Word Sentence**: This routine produces a sub-menu which asks if you want words, sentences, or to return to the main menu. It then sets the L series of variables (control variables) and returns.
1510–2010	**Change**: This subroutine produces a sub-menu which displays the current record and asks which entry you would like to change. It then displays the word or sentence and asks you for a new entry. The subroutine next loops back upon itself for additional changes until you end change. It then places the record in the file and returns. Note: 1510 is the entry point and loop back point. 1710 is the exit point.

Program Listing. Worte & Satze

```
70 PCLEAR1:FILES 3,512:GOTO40
80 CLEAR 3000
90 CLS:PRINT@165,"I NEED THE TIM
E OF DAY"
100 SOUND 200,3
110 PRINT@261,"WHAT IS THE HOUR
";
120 INPUT AW
130 IF AW=0 THEN AW=1
140 IF AW<0 OR AW>24 OR AW<>INT(
AW) THEN 110
150 TI=AW
160 SOUND 200,3
170 PRINT@293,"WHAT IS THE MINUT
ES ";
180 INPUT AW
190 IF AW=0 THEN AW=1
200 IF AW<0 OR AW>59 OR AW<>INT(
AW) THEN 170
210 TI=AW*TI
220 CLS:PRINT@231,"ONE MOMENT PL
EASE"
230 FORX=1 TO TI:S=RND(10):NEXT
240 N1$="WORTE"
250 N2$="SATZE"
260 N3$="GERMAN"
270 OPEN "D",#1,N1$,70
280 OPEN "D",#2,N2$,192
290 WL=LOF(1)
300 SL=LOF(2)
310 CLOSE
320 CLS
330 PRINT@165,"DO YOU WANT:"
340 PRINT@229,"1     TO ENTER"
350 PRINT@261,"2     ACTIVE (ENG
LISH)"
360 PRINT@293,"3     PASSIVE ("N
3$")"
370 PRINT@325,"4     TO END"
380 SOUND 200,3
390 AW$=INKEY$:IF AW$=""THEN390
400 AW=VAL(AW$)
410 IF AW<1 OR AW>4 THEN 390
420 IF AW=1 THEN 960
430 IF AW=2 THEN 710
440 IF AW=3 THEN 460
450 CLOSE:CLS:END
460 GOSUB 1390
470 IF WS=3 THEN 320
480 CT=0
490 GOSUB 1290
500 CLS
510 CT=CT+1
520 PRINT CT
530 PRINT@165,B1$
540 PRINT@229,C1$
```


☎ Enter 22 on TeleResponse page 134

```
550 PRINT@392,"- M - FOR MENU"
560 PRINT@423,"- C - FOR CHANGE"
570 PRINT@451,"ANY OTHER KEY FOR
 ENGLISH"
580 SOUND 200,3
590 AW$=INKEY$:IF AW$="" THEN 59
0
600 IF AW$="C" THEN 690
610 IF AW$="M" THEN 460
620 PRINT@293,A1$
630 PRINT@451,"ANY OTHER KEY TO
CONTINUE"
640 SOUND 200,3
650 AW$=INKEY$:IF AW$="" THEN 65
0
660 IF AW$="C" THEN 690
670 IF AW$="M" THEN 460
680 GOTO 490
690 GOSUB 1510
700 GOTO 490
710 GOSUB 1390
720 IF WS=3 THEN 320
730 CT=0
740 GOSUB 1290
750 CLS
760 CT=CT+1
770 PRINT CT
780 PRINT@165,A1$
790 PRINT@392,"- M - FOR MENU"
800 PRINT@423,"- C - FOR CHANGE"
810 PRINT@451,"ANY OTHER KEY FOR
 ";N3$
820 SOUND 200,3
830 AW$=INKEY$:IF AW$="" THEN 83
0
840 IF AW$="C" THEN 940
850 IF AW$="M" THEN 710
860 PRINT@229,B1$
870 PRINT@293,C1$
880 PRINT@451,"ANY OTHER KEY TO
CONTINUE"
890 SOUND 200,3
900 AW$=INKEY$:IF AW$="" THEN 90
0
910 IF AW$="C" THEN 940
920 IF AW$="M" THEN 710
930 GOTO 740
940 GOSUB 1510
950 GOTO 740
960 GOSUB 1390
970 IF WS=3 THEN 320
980 CLS:PRINT@456,"- M - FOR MEN
U"
990 PRINT@69,"ENGLISH PLEASE"
1000 PRINT@101,;
1010 SOUND 200,3
```


☎ Enter 66 on TeleResponse page 134

```
1020 LINE INPUT A1$
1030 IF A1$="M" THEN 1260
1040 IF LEN(A1$)<1 OR LEN(A1$)>L
1 THEN 1000
1050 PRINT@165,N3$;" PLEASE"
1060 PRINT@197,;
1070 SOUND 200,3
1080 LINE INPUT B1$
1090 IF B1$="M" THEN 1260
1100 IF LEN(B1$)<1 OR LEN(B1$)>L
2 THEN 1060
1110 PRINT@261,"PRONOUNCIATION P
LEASE"
1120 PRINT@293,;
1130 SOUND 200,3
1140 LINE INPUT C1$
1150 IF C1$="M" THEN 1260
1160 IF LEN(C1$)>L3 THEN 1120
1170 OPEN "D",#1,L4$,L4
1180 FIELD #1,L1 AS A$,L2 AS B$,
L3 AS C$
1190 LSET A$=A1$
1200 LSET B$=B1$
1210 LSET C$=C1$
1220 L5=L5+1
1230 PUT #1,L5
1240 CLOSE
1250 GOTO 980
1260 IF WS=1 THEN WL=L5
1270 IF WS=2 THEN SL=L5
1280 GOTO 960
1290 SEL=RND(L5)
1300 IF SEL<1 OR SEL>L5 THEN 129
0
1310 OPEN "D",#1,L4$,L4
1320 FIELD #1,L1 AS A$,L2 AS B$,
L3 AS C$
1330 GET #1,SEL
1340 A1$=A$
1350 B1$=B$
1360 C1$=C$
1370 CLOSE
1380 RETURN
1390 CLS:PRINT@165,"DO YOU WANT:
"
1400 PRINT@229,"1     WORDS"
1410 PRINT@261,"2     SENTENCES"
1420 PRINT@293,"3     MAIN MENU"
1430 SOUND 200,3
1440 AW$=INKEY$:IF AW$="" THEN 1
440
1450 AW=VAL(AW$)
1460 IF AW<1 OR AW>3 THEN 1440
1470 WS=AW
1480 IF WS=1 THEN L1=15:L2=25:L3
=30:L4=70:L4$=N1$:L5=WL
```

☎ Enter 42 on TeleResponse page 134

```
1490 IF WS=2 THEN L1=64:L2=64:L3
=64:L4=192:L4$=N2$:L5=SL
1500 RETURN
1510 CLS:PRINT@8,"C H A N G E"
1520 PRINT@64,"1    "A1$
1530 PRINT@160,"2    "B1$
1540 PRINT@256,"3    "C1$
1550 PRINT@352,"4    END CHANGE"
1560 PRINT@456,"WHICH ONE PLEASE
"
1570 SOUND 200,3
1580 AW$=INKEY$:IF AW$="" THEN 1
580
1590 AW=VAL(AW$)
1600 IF AW<1 OR AW>4 THEN 1580
1610 IF AW=1 THEN 1720
1620 IF AW=2 THEN 1820
1630 IF AW=3 THEN 1920
1640 OPEN "D",#1,L4$,L4
1650 FIELD #1,L1 AS A$,L2 AS B$,
L3 AS C$
1660 LSET A$=A1$
1670 LSET B$=B1$
1680 LSET C$=C1$
1690 PUT #1,SEL
1700 CLOSE
1710 RETURN
1720 CLS:PRINT@69,"CHANGE"
1730 PRINT@128,"FROM:"
1740 PRINT@165,A1$
1750 PRINT@256,"TO:"
1760 PRINT@293,;
1770 SOUND 200,3
1780 LINE INPUT A2$
1790 IF LEN(A2$)>L1 THEN 1720
1800 A1$=A2$
1810 GOTO 1510
1820 CLS:PRINT@69,"CHANGE"
1830 PRINT@128,"FROM:"
1840 PRINT@165,B1$
1850 PRINT@256,"TO:"
1860 PRINT@293,;
1870 SOUND 200,3
1880 LINE INPUT B2$
1890 IF LEN(B2$)>L2 THEN 1820
1900 B1$=B2$
1910 GOTO 1510
1920 CLS:PRINT@69,"CHANGE"
1930 PRINT@128,"FROM:"
1940 PRINT@165,C1$
1950 PRINT@256,"TO:"
1960 PRINT@295,;
1970 SOUND 200,3
1980 LINE INPUT C2$
1990 IF LEN(C2$)>L3 THEN 1920
2000 C1$=C2$
2010 GOTO 1510
```

E-X-P-L-O-R-E PROGRAMMING with the Finest Tools from

PASCAL

COLOR PASCAL

Now you can learn about and program in one of the most popular new languages available without investing in a large computer system. Although our Dynasoft PASCAL is not an 'extended' version, the user will find that virtually any task can be accomplished using the commands available plus external calls to your own routines.

What do you get? THE WHOLE THING: COMPILER, P-CODE, INTERPRETER, SUPERVISOR, SAMPLE PROGRAMS, plus a complete instruction manual with examples. Based on a subset of standard PASCAL, it includes most of the standard control structures but omits some of the more sophisticated data structures and floating point arithmetic. The result is a complete high-level language system which retains most of the flavor and structure of standard PASCAL but will run on a system with as little as 32K memory and a cassette. Below is a summary of Color PASCAL's features:

Reserved Words

AND	ARRAY	BEGIN	CASE	CONST	DIV
DO	DOWNTO	ELSE	END	EXTERN	FOR
FORWARD	FUNCTION	IF	MOD	NOT	OF
OR	OTHERWISE	PROCEDURE	PROGRAM	READ	REPEAT
THEN	TO	TYPE	UNTIL	VAR	WHILE
WRITE	WRITELN	NEW	MARK		

Supervisor Commands

Load	Save	Edit	Compile	Go	Gp
Move	Quit				

NEW DISK PASCAL

Disk PASCAL includes these added features:

- The compiler requires less than 16K, allowing for larger programs. In fact, source programs can be larger than memory as code is compiled from the disk.
- Directed I/O allows channeling of the input and output to the screen, printer, or disk. One of the example files provided outputs a file to the screen, printer, or disk at your choice! This means the same program can display, print, or copy files to disk.
- The entire PASCAL system is contained in two files, leaving plenty of disk space for the program development.
- An editor is required to create the Pascal source files (ASCII files). Computerware's Color Editor is available with the Pascal package at a discount.

DISK FILE ACCESS

OPEN CREATE CLOSE FREAD FWRITE
DELETE RENAME DSIO*

DSIO allows reading & writing directly to a specific sector anywhere on the disk!

GRAPHICS & JOYSTICK

PROCEDURE GMODE(MODE) — Enter one of three graphics modes or return to the text mode. All graphics modes have a resolution of 127 x 191. Artifact colors are supported.

PROCEDURE LINE (X1,Y1,X2,Y2,COLOR) — Draw a line from (X1,Y1) to (X2,Y2) in the specified COLOR.

PROCEDURE PSET(X,Y,COLOR) — Turns on the pixel at (X,Y,) to specified color.

PROCEDURE PCLS(COLOR) — Clear the graphics screen to COLOR.

FUNCTION PPOINT(X,Y) — Returns the color code of the specified pixel.

FUNCTION JOYSTICK(NUMBER) — Returns the value of any of the joysticks or the buttons.

PROCEDURE SOUND(TONE,DURATION) — Plays a note on the TV speaker of the specified TONE for the specified duration.

32K Cassette **$49.95** 32K Disk **$69.95**
32K Disk w/Editor **$89.95**

64K SCREEN EXPANDER

64K SCREEN EXPANDER

- 64 x 24 or 51 x 24 screen display, upper/lower case with true decenders.
- Allows mixing of text and hi-res graphics on the same screen easily.
- Character set editor allows you to create your own characters.
- Auto Repeat — hold down any key longer than normal and it will begin repeating.
- Type Ahead means that while the screen is displaying you can type a command. Then when the display is finished what you typed has already been accepted as input.
- Both PRINT @ formats — the standard BASIC format or one using standard X,Y coordinates.
- ON ERROR to make error trapping possible. No more program crashes!
- AUTO LINE numbering while entering a program.
- Enhanced PMODE command allows you to specify page 0 as the start page.
- Very FAST hi-res display!
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EPROM Programmer

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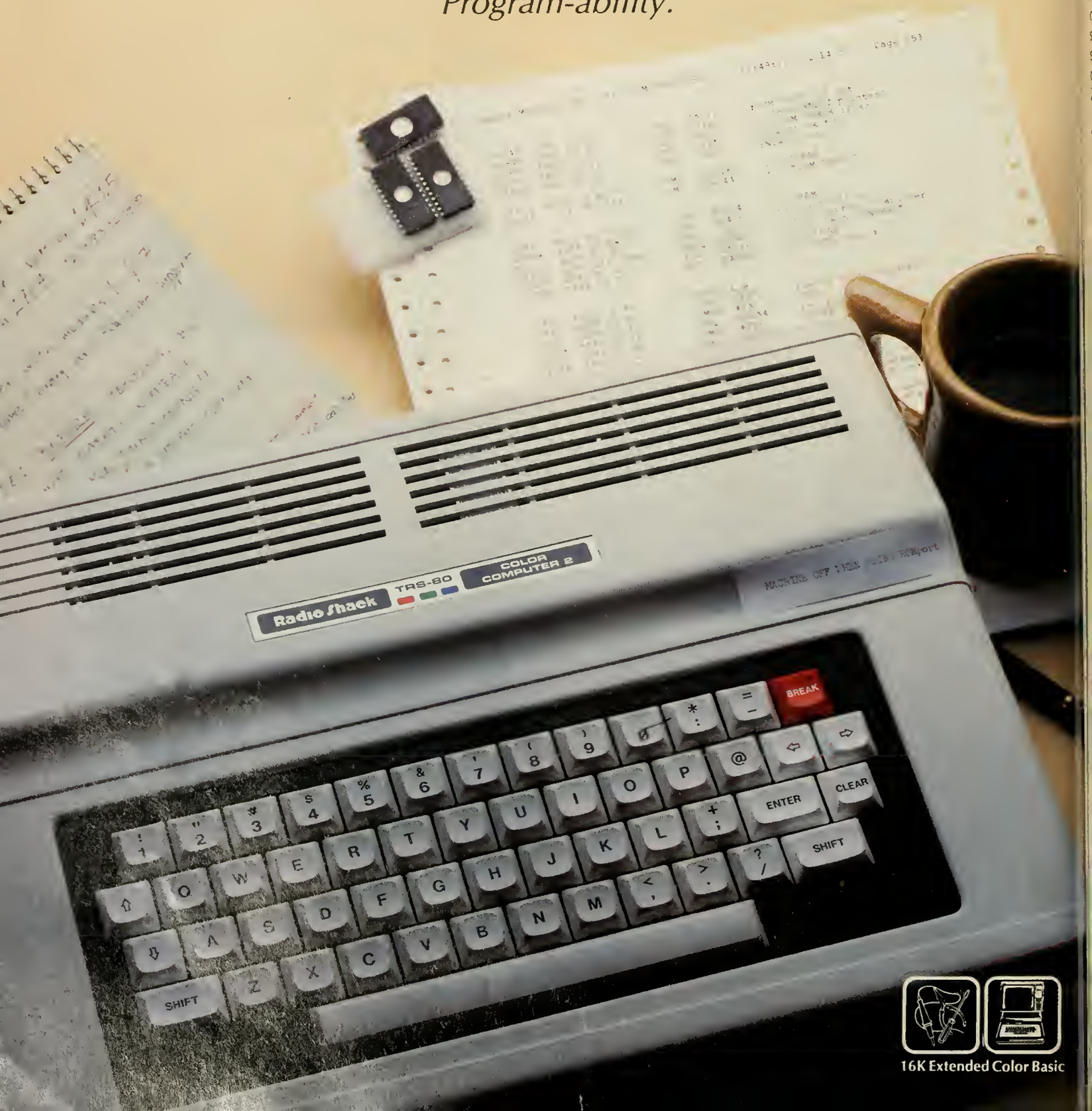


16K Extended Color Basic

EPROMS CAN BE A GREAT convenience for the Color Computer owner, providing a relatively inexpensive medium for program or data storage. The best EPROM buys at this time are probably the 2732 or 2732A (4K bytes, about $4) and the 2764 (8K bytes, about $7). Units having a 250 nanosecond access time are fast enough even for the Color Computer's high clock speed. A single 2764 in a ROM cartridge, occupying addresses $C000 – $DFFF, can store a number of utilities (like a disassembler, monitor, and such) with plenty of room left over for some games! I use 2716s in a Micro Works (of Del Mar, CA) "Romless Pak," and am in the process of building my own program packs to hold the 8K EPROMs.

Until quite recently, there were no EPROM programmers specifically for the Color Computer, and general-purpose stand-alone units still cost hundreds of dollars. At least one commercially built programmer plug-in is now being advertised at a reasonable price. Making your own, however, is an easy project for the somewhat experienced builder. The programmer I'll describe is a completely self-contained plug-in unit that derives all its power from the Color Computer, and requires no external power supply as do many designs. It can program any 5-volt-only EPROM; I'll give you the driver programs for programming and verifying the 2716, 2732, 2732A, and 2764, because those are probably the cheapest and easiest to use.

The Programmer Circuit

Figure 1 is the circuit diagram of my unit, and Table 1 is the parts list. The EPROM data pins are interfaced to the Color Computer data bus through Port A of a 6522 Versatile Interface Adapter (VIA) chip, and programming control signals are routed through Port B. The EPROM address pins are driven by a CD-4040 12-stage CMOS counter, providing addresses on lines A0 – A11. A12, needed only by an 8K EPROM, is provided through VIA Port B. 25 and 21 volt programming voltages are supplied by a dc-to-dc converter, using a 555 as an oscillator driving a voltage-quadrupler circuit.

The programmer features a hardware-generated programming pulse, reducing the chance of EPROM damage from errors in a driver program. The 5-volt supply is switched to the EPROM under program control; but, as a further safety precaution, the application of the programming voltage requires manual switching by the operator. Green and red LEDs inform the user when the respective voltages are applied to the programming socket. Appropriate software prompts are used to reduce the risk of inserting or removing an EPROM when the supply voltages are connected to the programming socket.

Because the various EPROMs use slightly different pinouts and program/read procedures, an EPROM-Type Module (ETM) is used to set up the circuit for each type. A 16-pin DIP socket accepts modules consisting of 16-pin headers with covers, wired to route signals to the correct programming-socket pins for each kind of EPROM. The choice between +21 or +25 volt programming voltage is made by the ETM, again reducing the chance of operator error. Zero insertion force (ZIF) sockets are used to hold the EPROMs.

by William C. Clements, Jr.

Construction

I built my unit on a 4 inch long by 3½ wide (102 mm by 89 mm) piece of Vector perfboard with bolted-on contact fingers. These fingers were prepared by etching a piece of double-sided printed circuit board stock with 20 contacts per side on 0.1 inch centers, as required by the Color Computer cartridge connector. Since building this version, however, Radio Shack has introduced a blank prototyping card (276-163 at $4.95) that will plug into the cartridge slot. It would be much easier to use their board, and I plan to do so myself in future projects.

Figure 2 shows the positions of the sockets and other major parts. The Radio Shack board is a little longer than mine, so if you use theirs you can stretch the parts out a bit along the length of the board and have more room to do the wiring.

First, lay out the integrated circuit sockets and attach them to the board with a small dab of quick-setting epoxy at each end. Don't get any glue on the contacts. When the epoxy has set firmly, you can proceed with the wiring.

The limited height in the cartridge slot precludes the use of wire-wrap sockets; you only have about 12 mm above the board and eight mm below to work in, so you must wire the circuit with fine wire and a small-tipped soldering pencil using small solder. I used the 28-gauge wire Vector sells as a refill for their wiring pencil for all except the power connections to the sockets (for those I used scraps of ordinary 22-gauge hook-up wire). The Vector wire has solder-through insulation and eliminates stripping the ends of all those fine wires. If you use it, take care to heat the joints enough to fully vaporize the insulation so you'll get a proper connection.

Lay the 0.1 microfarad bypass capacitors flat, connecting one directly across the power supply pins of each integrated circuit socket. Wire a 10 microfarad electrolytic between the ground and +5 volt fingers at the contact end of the board, observing correct polarity. Placement of other parts is not especially critical, but I had to stand the resistors on end and use especially small electrolytics in the dc – dc inverter part of the circuit to make it all fit on my crowded board. If you use the Radio Shack board you shouldn't have to do anything special to get everything in.

Trace over each connection on the circuit diagram in red pencil as you make it. When you have colored all traces, use an ohmmeter to verify each connection, and retrace the diagram with another color as you check each line. You must be absolutely sure your wiring is correct before plugging the unit into the cartridge connector; the address and data buses of Color Computer's 6809E microprocessor connect directly to the expansion socket with no protective buffering. Wiring errors could damage the 6809E and associated circuits in the computer, as well as components on your programmer.

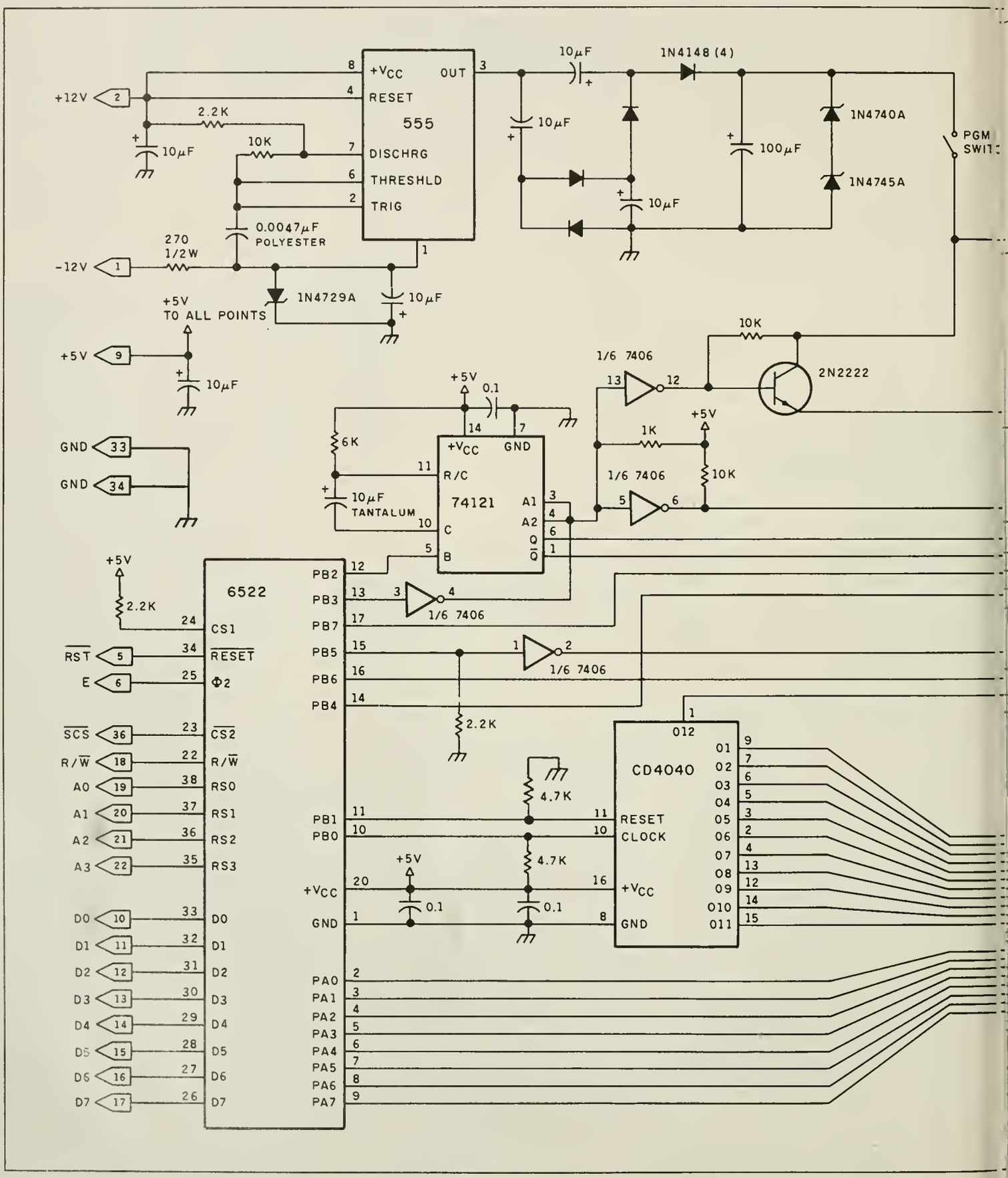
Finally, prepare the ETMs. Wire each 16-pin header plug according to the directions in Table 2. Glue on the covers and label each with the EPROM type using a stick-on label.

When you are sure all wiring is correct, plug the Color Computer into a grounded (three-prong) ac outlet, and check that the computer's power switch is off. Ground yourself by holding the outside of the TV jack with one hand, and then pick up and insert the 6522 and the CD4040 carefully into their sockets with

photo by Charley Freiberg

your other hand. These two integrated circuits, along with the EPROM, are sensitive to static electricity, so it is a good idea to ground your body before handling them. The remaining integrated circuits are not static sensitive and can be socketed with no special precautions. To avoid risk of shock, do not touch any other appliance while you are grounded. Some of the sensitive integrated circuits' pins connect directly to the contact fingers, so you should avoid touching these fingers in handling the finished programmer.

It wouldn't be a bad idea to protect the wiring under the board and the integrated circuits on top by covering them with insulating material. A thin piece of acetate sheet, perhaps cut from a dimestore report cover, could be cut to the board dimensions and affixed to the wir-

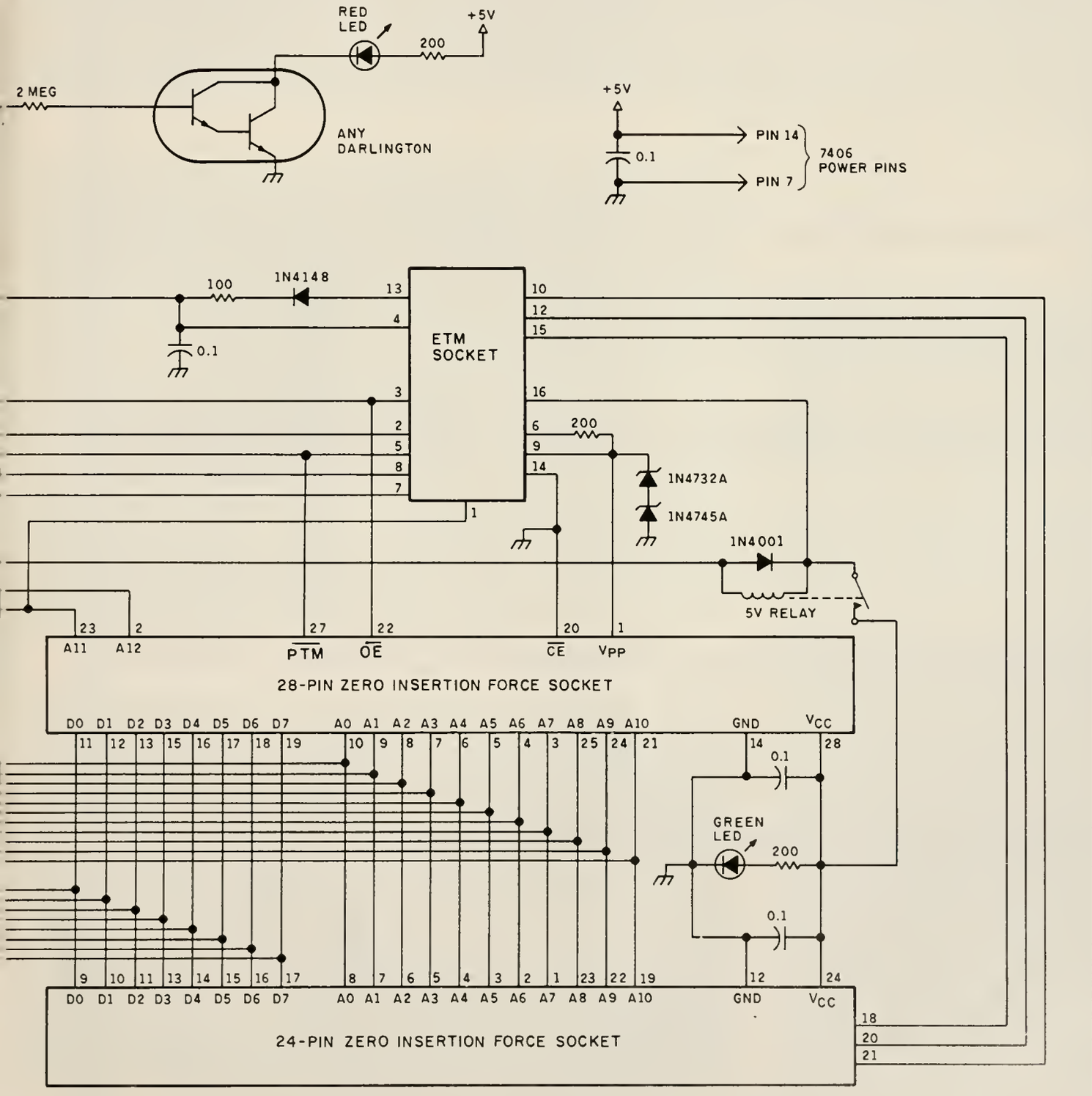


ing side using double-stick foam tape. A similar piece, cut short to expose the rear of the board for access to the EPROM sockets, the ETM, and the program switch can be fastened to the top with a little glue on top of each integrated circuit. This would protect the board when being handled and prevent contact with the Color Computer case and the metal cartridge slot door. Of course, you could build a case for the board (similar to a program pack only larger) if you're handy at that sort of thing.

Listings 1 and 2 give two Extended Basic programs to drive the programmer. Listing 1 will program the 2716, 2732, and 2732A. Listing 2, for the 2764, has additional logic to provide the A12 address line through PB6 of the VIA. Table 3 explains the use of each VIA port bit in

more

Figure 1. Circuit Diagram



Resistors
¼ watt, 5% except as noted
1 100 ohm
3 200 ohm
1 270 ohm ½ watt
1 1 K
3 2.2 K
2 4.7 K
1 6 K
3 10 K
1 2 Megohm

Integrated Circuits
1 555
1 CD4040
1 6522
1 7406
1 74121

Capacitors
1 0.0047 mfd. polyester
7 o.1 mfd. disk
6 10 mfd. 16 volt electrolytic
1 100 mfd. 25 volt electrolytic
1 10 mfd. 35 volt tantalum

Sockets and Plugs
1 8-pin DIP socket
2 14-pin DIP socket
2 16-pin DIP socket
1 40-pin DIP socket
1 24-pin zero insertion force DIP socket
1 28-pin zero insertion force DIP socket
1 16-pin DIP header plug and cover for each EPROM type you wish to program

Diodes
1 1N4001
7 1N4148
1 3.6v,5% zener (1N4729A)
1 4.7v,5% zener (1N4732A)
1 10 v,5% zener (1N4740A)
2 16 v,5% zener (1N4745A)

Miscellaneous
1 2N2222 transistor MPSA13 or Radio Shack 276-2060
1 Darlington transistor
1 Red LED
1 Green LED
1 Miniature SPST switch
1 Reed relay, 5 volt coil (Radio Shack 275-228)
1 40-pin prototyping board (Radio Shack 276-163)
Misc. wire and solder

Table 1. Parts List

EPROM Type	Connect 16-Pin DIP Header Pin:	To Pin:
2716	2	7 and 15
	3	12
	4	10
	13	16
2732*	1	10
	5	7
	4	12
	13	14
2732A*	1	10
	4	6
	5	7
	9	12
	13	14
2764	4	6
	5	7
	13	16

*In addition to the wiring in the table above, the 2732 and 2732A EPROMs each require the addition of three components:

- Connect a 2.2 K, ¼ watt resistor between pins 15 and 16
- Connect a 1N4148 diode: cathode to pin 5, anode to pin 15
- Connect a 1N4148 diode: cathode to pine 8, anode to pin 15

Table 2. Wiring Directions

6522 Pin No.	I/O Port Bit	Function
2-9	Port A (PA0–PA7)	Data word to EPROM
10	PB0	Take high-low-high to advance EPROM address
11	PB1	Take low-high-low to reset EPROM address to zero
12	PB2	Take low-high-low to generate one 50-ms programming pulse
13	PB3	Low: read EPROM. High: program.
14	PB4	Connected to 50-ms prog, pulse; used to sense when pulse is over
15	PB5	Low: +5 volts, EPROM supply voltage off. High: +5 volts on
16	PB6	Address line A12 (2764 only)
17	PB7	Used to switch 2732, 2732A EPROMS into read mode after programming, to allow vertification

Table 3. VIA Port Bits

Programming One Byte

Set up the EPROM address on its address lines and place the data word to be programmed at that address on the data lines. Then follow the procedure given below for each EPROM. Pin numbers are in parentheses; programming voltages are to be 21 volts ± 0.5 volts, or 25 volts ± 1 volt, as indicated for each type. "Low" and "high" refer to TTL logic levels. Signal notation per Intel spec sheets.

2716 Take $\overline{CE}$ (20) high and PD/$\overline{PGM}$ (18) low; apply +25 volts to V_{pp} (21). Bring PD/$\overline{PGM}$ high for 50 ms, then return to low state.
2732 Take $\overline{CE}$ (18) high, apply +25 volts to $\overline{OE}/V_{pp}$ (20). Bring $\overline{CE}$ low for 50 ms, then return to high state.
2732A Same as 2732 except use +21 volts at $\overline{OE}/V_{pp}$ (20).
2764 Take $\overline{CE}$ (20) low; take $\overline{PGM}$ (27) and $\overline{OE}$ (22) both high; apply +21 volts to V_{pp} (1). Bring $\overline{PGM}$ low for 50 ms, then return to high state.

Reading One Byte

Set up the EPROM address on its address lines and follow the procedure given below for each EPROM type.

2716 Take $\overline{CE}$ (20) and PD/$\overline{PGM}$ (18) both low; apply +5 volts to V_{pp} (21).
2732,2732A Take $\overline{CE}$ (18) and $\overline{OE}/V_{pp}$ (20) both low.
2764 Take $\overline{CE}$ (20) and $\overline{OE}$ (22) both low; take $\overline{PGM}$ (27) high; apply +5 volts to V_{pp} (1).

Table 4. Protocol

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the circuit, and Table 4 summarizes the program and read protocol for the EPROMs discussed here. Using these tables, together with the commented listings, you should be able to follow the sequence of programming steps and the operation of the programmer unit for each type of EPROM.

The programmer is used as follows. First, with the computer plugged in but turned off, carefully insert the programmer into the Color Computer, taking care that the metal door over the slot does not hang up on the integrated circuits or short out anything. Insert the correct ETM for the EPROM type you are using, but do not insert the EPROM yet. Check to see that the "program" switch is turned off. Turn on the computer, load into RAM the code to be burned into the EPROM, then load the appropriate program from Listing 1 or 2 and run it. You will be prompted exactly what to do. You can program an entire EPROM or any part of it. You will be asked to enter the range of EPROM addresses to be programmed, relative to the first location as zero, and you will enter the first hex RAM address at which your code begins. Follow the instructions the program gives you about inserting and removing the EPROM. The program first checks that all the locations to be burned are erased (contain #$FF or all one-bits). During programming, the EPROM address is displayed as it is programmed so you can follow the progress of the program. Finally, after programming is finished, the contents of the EPROM are checked against RAM to verify successful programming.

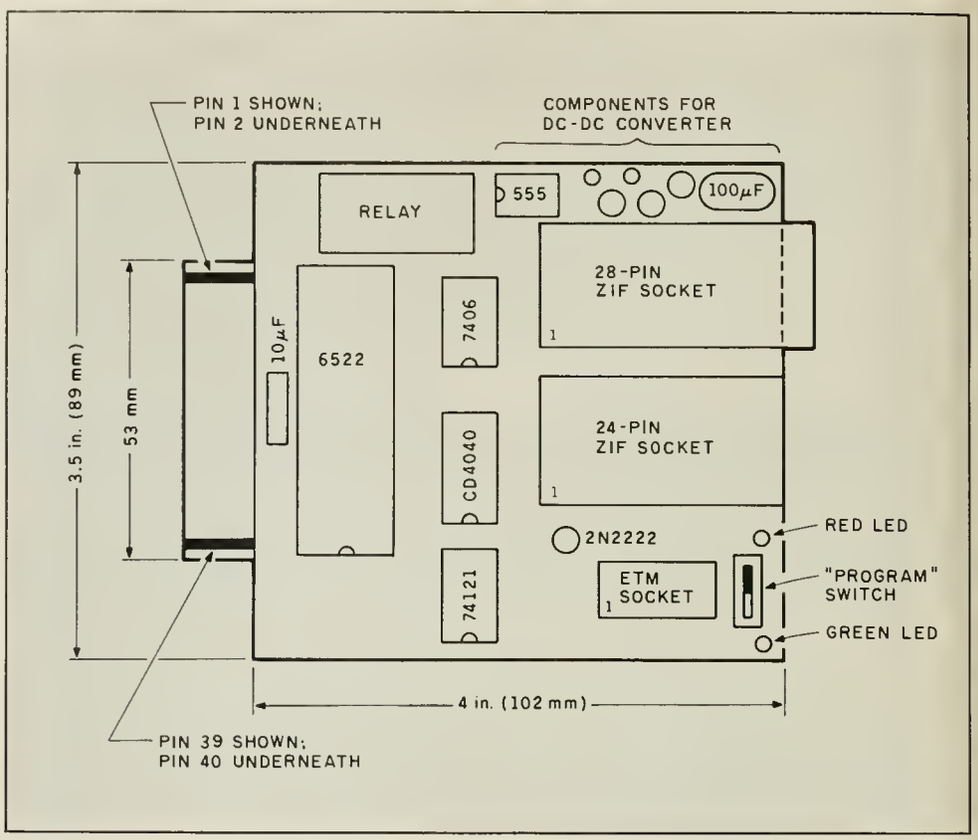

Figure 2. Parts Positioning

Software You Can Use

The cartridge slot is decoded for the address range $C000 – $FEFF, a total of nearly 16K locations. Thus, as many as two 2764s, or their equivalent in smaller EPROMs, can be used in a cartridge; only the last 256 locations in the upper 16K of the address space, between $FF00 – $FFFF, can't be used, because those addresses are used internally by the Color Computer. The remaining space can't easily hold Basic program statements, because Basic expects its statements to be stored below $8000. (Some companies do sell programs to convert Basic statements to a form that can be stored in EPROM.) The cartridge slot is really intended for assembly language code that is assembled to work in the $C000 – $FEFF range, or better still, code that is

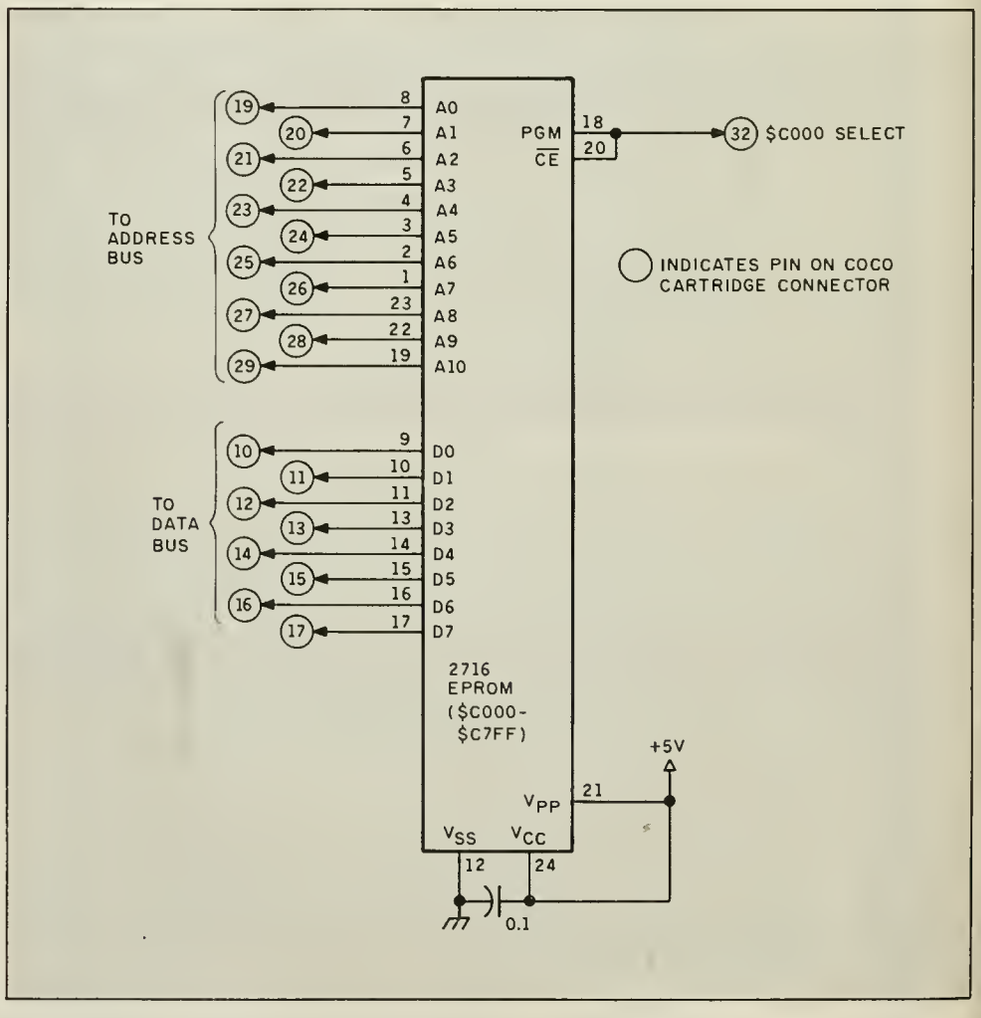

Figure 3. 2716 EPROM Circuit

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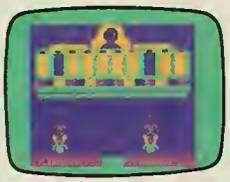

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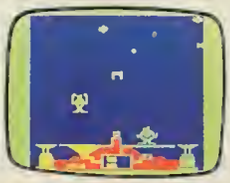

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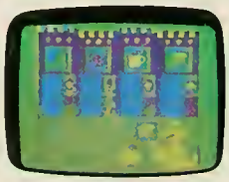

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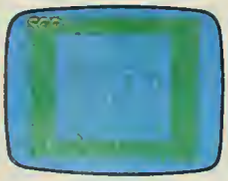

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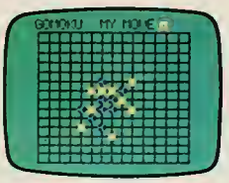

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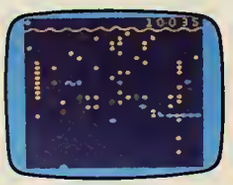

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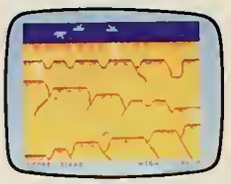

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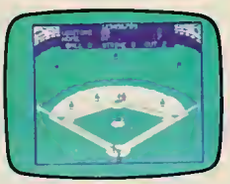

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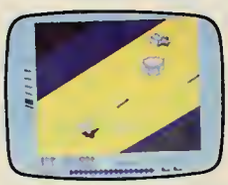

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position independent. Some published code and commercial programs will work anywhere in memory, and for your convenience it's a good idea to write your own code that way. The program-counter relative addressing mode of the 6809 makes it fairly simple to do so. Several commercial programs that are position independent are The Micro Works' CBUG monitor, and its MACRO-80 assembler and editor, and Radio Shack's EDTASM+ (which however is already supplied in ROM!). One published program that I've found very useful is an assembly language 6809 disassembler (*BYTE* 7, No.2, February, 1982), pp. 340 – 364). It takes a lot of typing, but the result is well worth the effort. With a suitable driver program, that subroutine will make short work of a lengthy disassembly job. Programs like those mentioned here are all worth saving in EPROM.

Suggestions and Comments

There are a couple of variations from my unit that you might want to consider when you build yours. The first I have mentioned already: using the Radio Shack project board and spreading the parts out more. Second, I built this unit back when 2732s and 2764s were expensive, and so it was originally designed just for 2716s. When the 4K and 8K chip prices fell to current levels, I added the 28-pin ZIF socket to accommodate the 2764. The pins on the 2716 and 2732 are nearly all compatible with the upper 24 pins of the 2764, however, so you could get by nicely with only the 28-pin socket and save about $10 by inserting the 24-pin chips at the top of the socket and leaving pins 1, 2, 27, and 28 empty. The wiring changes needed to do that could be handled by altering the ETMs, consulting a specification sheet for the EPROMs to figure out the new wiring. I recommend that you do it only if you have some experience with circuit design. Of course, if you're not interested in the 2764, you could just omit its socket. Alternatively, you could build just a 2764 programmer by leaving out the 24-pin ZIF socket and the ETM completely, wiring the 28-pin socket permanently for the 8K chip.

It wouldn't be hard to work out ETMs and driver software for other EPROM types, if you have that need. Both high-true and low-true 50-millisecond programming pulses are available at the 74121 socket, and any programming voltage up to 25 volts can be provided by using zener diodes of the proper value across the output of the dc – dc converter, as I did to get the 21 volt supply for the 2732s and the 2764.

Also, the programmer will handle the 27128 chip (this 16K byte EPROM presently costs about $20); the additional address line (A13) it needs could be provided by the driver program through port bit PB7, and the 2764 program could be modified to keep up with the extra 8K of space.

Because the driver programs are written in Basic, they are rather slow. Run times range from about five minutes for a 2K ROM to about 45 minutes for 8K. For the occasional user, the times are not a serious inconvenience, but if you're going to burn a lot of 8K units in one session you might want to reprogram the routines in assembly language.

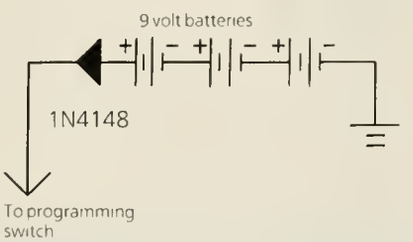
There would be an advantage besides speed to having assembly language versions of the routines; they could then be stored in an EPROM on the programming board using Listing 1. Once this ROM was burned, the Basic programs would then be unnecessary. For those who are interested, Figure 3 gives the circuit needed to add a socket for a 2716 EPROM. 2K will be plenty of room for all the assembly language programs and utility routines you want.

Anyone who works with EPROMs will need an ultraviolet lamp for erasing them. Most commercial units are too expensive, in my opinion. It's a lot cheaper to get an ultraviolet lamp and a ballast from an electrical supply house and make your own. Several articles describing home built erasers have appeared from time to time; I recommend *BYTE* 2, No. 1 (Jan., 1977), p. 91, and *BYTE* 5, No. 4 (April, 1980), pp. 234-8 in particular. I built the "coffee-can" eraser from the 1977 reference and it works well. ■ ■ ■

An Update

Since this article was prepared, Radio Shack has removed the original Color Computer from its shelves — only the Color Computer 2 is now available. The programming-voltage generating circuits of the programmer use the +12-volt power supply that is present in the original Color Computer but is not in the Color Computer 2. The programmer works fine with a CC2 if the programming voltage is added with an external power supply. To do so, break the connection between the programming switch and the 1N4740A diode and patch an external +26 volt source to the free side of the switch, the negative connected to the programmer's ground bus. An easy source of the needed voltage is a trio of nine-volt transistor-radio batteries in series with a silicon diode, as shown below.

This external supply has worked with the occasional EPROM that refuses to program from the on-board supply. Apparently these parts have wide variations in their current requirements. When you do substitute batteries, be sure that the on-board supply is disconnected as described *before* attaching the batteries.



Program Listing 1. For The 2716, 2732, and 2732A

```
10 ' EPROM PROGRAMMER DRIVER PRO
GRAM
20 ' FOR 2716, 2732, AND 2732A
30 ' WILLIAM C. CLEMENTS, JR.
40 ' BOX 2662, UNIVERSITY, AL  3
5486
50 ' VIA PORT B AT $FF40, PORT A
 AT $FF41
60 ' DATA DIRECTION REGISTERS: F
OR B AT $FF42, FOR A AT $FF43
```

more

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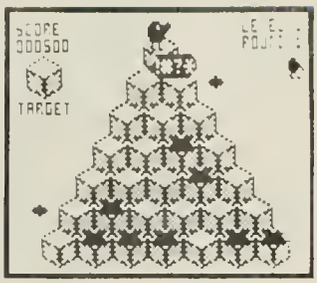

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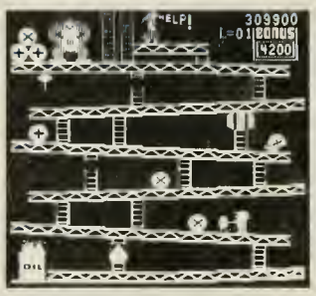

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Previously called 'Donkey King', you simply cannot buy a more impressive game for your CoCo. With 4 different screens and loads of fun! From Tom Mix Software. 32K Tape: $25.95

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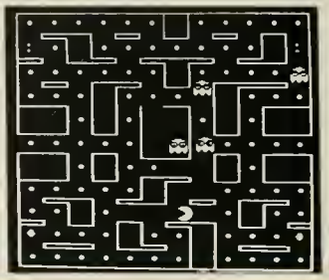
From Spectral Assoc. This "PAC" theme game has been improved several times. It is definitely the best of its type. Brilliant color, action and sound, just like an arcade. 16K Tape: $24.95



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Included free with 'Real Talker' is Colorware's remarkable Text-to-Speech program. This is a truly powerful machine language utility. What it does is automatically convert plain English to speech. And it has an unlimited vocabulary! For example, use it in the direct mode: Type in a sentence or a paragraph, even mix in numbers, dollar signs, etc., then press enter. The text is spoken. At the same time a phoneme string is generated which can be saved to cassette or disk, modified or used in a Basic program.

We originally planned to sell this major piece of programming for about $40.00 but decided it was so useful that no 'Real Talker' user should be without it. Besides, it really shows off the capability of 'Real Talker'.

Also included with 'Real Talker' is our unique Phoneme Editor program. It allows you to explore and create artificial speech at the phoneme level. Phonemes are the fundimental sounds or building blocks of word pronunciation. There are 64 different phonemes, as well as 4 inflection levels at your disposal. Creating and modifying speech at the phoneme level is both fascinating and educational. The Phoneme Editor may also be used to customize the pronunciation of speech produced by the Text-to-Speech program.

You don't have to use any of our utility programs though. If you write your own Basic Programs, you will find the pocket sized Votrax Dictionary (included free) is all you need to make your own Basic programs talk. This dictionary gives you quick access to the phoneme sequences used to create approximately 1400 of the most used words in the English language.

How about compatibility? 'Real Talker' is compatible with any 16K, 32K, 64K, Extended or non-extended Color Computer. It works with any cassette or disk based system, with or without the Radio Shack Multi-slot expander. No other synthesizer under $100 can make this claim. Most other CoCo voice synthesizers require an expensive Multi-slot expander in order to work with the disk system. 'Real Talker' requires only an inexpensive Y-adapter. This is an important consideration if you plan on adding a disk or have one already.

'Real Talker' comes completely assembled, tested and ready to use. It is powered by the CoCo and talks through your T.V. speaker so there is nothing else to add. Price includes Text-to-Speech and other programs on cassette (may be transferred to disk), User Manual and Votrax Dictionary. ONLY $59.95

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```
70 ' 0 IN BIT I OF DIRECTION REG
ISTER CONFIGURES
80 ' BIT I OF PORT AS INPUT; A 1
 CONFIGURES IT AS OUTPUT
90 B=&HFF40:C$=CHR$(13)
100 POKEB+2,&HEF:POKEB,1:POKEB+3
,0 'CONFIGURE PORTS & INITIALIZE
 CONTROL LINES
110 CLS:PRINT@7,"EPROM PROGRAMME
R":PRINT@96,"MAKE SURE THE +25V.
 SUPPLY"C$"IS SWITCHED OFF."C$C$
"INSERT EPROM INTO PROGRAMMING"C
$"SOCKET."
120 PRINTC$"PRESS <2> TO PROGRAM
 A 2716"C$"   OR <4> TO PROGRAM
A 2732              OR 2732A"
130 D$=INKEY$:IF D$=""THEN130
140 IF D$="2" THEN FLAG=16 ELSE
IF D$="4" THEN FLAG=0 ELSE 130
150 PRINT:INPUT"FIRST EPROM LOCA
TION (HEX)";F$:INPUT"LAST  EPROM
 LOCATION (HEX)";L$
160 F=VAL("&H"+F$):L=VAL("&H"+L$
):PRINTC$"NOW VERIFYING ERASURE"

170 POKEB,33 '+5V. ON, CLOCK HIG
H, PB7 LOW TO VERIFY 2732 ERASUR
E
180 GOSUB480
190 PRINT:J=0
200 FORI=F TO L:IF PEEK(B+1)<>25
5 THEN PRINT"LOCATION";I;" IS #$
";HEX$(PEEK(B+1)); ", NOT #$FF":
J=1
210 POKEB,PEEK(B)AND&HFE:POKEB,P
EEK(B)OR1 'ADVANCE ADDRESS COUNT
ER
220 NEXT:IF J THEN PRINT:PRINT"E
RASE EPROM AND TRY AGAIN":GOTO47
0
230 PRINT"ALL LOCATIONS TO BE PR
OGRAMMED"C$"ARE INITIALLY ERASED
."C$C$"INITIALIZING EPROM ADDRES
S NOW."C$
240 GOSUB480
250 PRINT"AT WHAT HEX MEMORY LOC
ATION":INPUT"DOES YOUR DATA BEGI
N";D$:D=VAL("&H"+D$)
260 PRINT:PRINT"TURN ON THE +25V
. SUPPLY, THEN":PRINT"HIT ANY KE
Y TO START PROGRAMMING"
270 IF INKEY$="" THEN 270 ELSE P
OKEB+3,255 'CONFIGURE A AS OUTPU
T PORT NOW
280 POKEB,PEEK(B)OR136 'CONNECT
VPP; PB7=1 TO PROGRAM 2732
290 J=0:CLS3:PRINT@36,"NOW PROGR
AMMING LOC. $";
300 ' PROGRAMMING ROUTINE
310 FORI=F TO L
320 PRINT@58,HEX$(I);
330 POKEB+1,PEEK(D+J):POKEB,PEEK
(B)OR4 'POKE DATA AND STROBE 50
MS PULSE
340 IF (PEEK(B)ANDl6)=FLAG THEN
340 ELSE POKEB,PEEK(B)AND&HFB 'R
ESTORE PROG. PULSE STROBE WHEN 5
0 MS PULSE IS OVER
350 POKEB,PEEK(B)AND&HFE:POKEB,P
EEK(B)OR1 'ADVANCE ADDRESS
360 J=J+1:NEXT
370 POKEB,PEEK(B)AND&HF7 'REMOVE
 VPP & SET 2716'S CE LOW
380 CLS6:PRINT"PROGRAMMING IS CO
MPLETE."C$"NOW INITIALIZING ADDR
ESS."
390 POKEB+3,0 'NOW PORT A = INPU
T
400 POKEB,PEEK(B) AND 127 'PB7=0
 SWITCHES 2732, 2732A'S OE LOW T
O VERIFY
410 GOSUB480
420 CLS6:PRINT"VERIFYING EPROM N
OW: LOC. $";
430 J=0:PRINT:FORI=F TO L:PRINT@
27,HEX$(I);
440 IF PEEK(B+1)=PEEK(D+J) THEN
450 ELSE PRINT@64,"LOCATION $";H
EX$(I);" IS #$";HEX$(PEEK(B+1))C
$"BUT  SHOULD BE #$";HEX$(PEEK(D
+J))
450 J=J+1:POKEB,PEEK(B)AND&HFE:P
OKEB,PEEK(B)OR1:NEXT
460 PRINTC$"VERIFICATION ROUTINE
 COMPLETED."C$"TURN OFF THE +25V
. SUPPLY"C$"AND REMOVE THE EPROM
."
470 POKEB,PEEK(B)AND&HDF:END 'TU
RN +5V. OFF AND END.
480 POKEB,PEEK(B)OR3:POKEB,PEEK(
B)AND&HFD 'CLEAR EPROM ADDRESS C
OUNTER TO ZERO
490 IF F=0 THEN RETURN
500 FORI=1TOF
510 POKEB,PEEK(B)AND&HFE:POKEB,P
EEK(B)OR1 'ADVANCE ADR. COUNTER
520 NEXT:RETURN 'EPROM NOW AT IT
S START ADDRESS
```

more

Program Listing 2. For The 2764

```
50 B=&HFF40:C$=CHR$(13) 'VIA AT
$FF40 AGAIN; SEE LISTING 1 FOR D
ETAILS
60 POKEB+2,&H6F:POKEB,1:POKEB+3,
0 'CONFIGURE PORTS & INITIALIZE
CONTROL LINES
70 CLS:PRINT@7,"2764 PROGRAMMER"
:PRINT@96,"MAKE SURE THE +25V. S
UPPLY"C$"IS SWITCHED OFF."C$C$"I
NSERT 2764 INTO PROGRAMMING"C$"S
OCKET.  PRESS ""G"" WHEN READY."
HC$C$
80 IF INKEY$="G" THEN 90 ELSE 80
90 INPUT"FIRST EPROM LOCATION IN
 HEX";F$:F=VAL("&H"+F$):INPUT"LA
ST EPROM LOCATION IN HEX";L$:L=V
AL("&H"+L$):PRINTC$"NOW VERIFYIN
G ERASURE"
100 IF F<4096THENFF=F ELSEFF=F-4
096
110 POKEB,33 '+5V. ON, CLOCK HIG
H
120 GOSUB460
130 'VERIFY #$FF ROUTINE
140 PRINT:J=0:FORI=F TO L
150 IF I>4095THENPOKEB,PEEK(B)OR
64 'SET A12 IF 4K BOUNDARY CROSS
ED
160 IF PEEK(B+1)<>255 THEN PRINT
"LOCATION";I;" IS #$";HEX$(PEEK(
B+1)); ", NOT #$FF":J=1:ELSE170
170 POKEB,PEEK(B)AND&HFE:POKEB,P
EEK(B)OR1 'ADVANCE ADDRESS COUNT
ER
180 NEXT:IF J THEN PRINT:PRINT"E
RASE EPROM AND TRY AGAIN":GOTO44
0:ELSE190
190 PRINT"ALL LOCATIONS TO BE PR
OGRAMMED"C$"ARE INITIALLY ERASED
."C$C$"INITIALIZING EPROM ADDRES
S NOW."C$
200 GOSUB460 'GO TO FIRST EPROM
ADDRESS
210 PRINT"AT WHAT HEX MEMORY LOC
ATION":INPUT"DOES YOUR DATA BEGI
N";D$:D=VAL("&H"+D$)
220 PRINTC$"TURN ON THE +25V. SU
PPLY, THEN"C$"HIT ANY KEY TO STA
RT PROGRAMMING"
230 IF INKEY$="" THEN 230 ELSE P
OKEB+3,255 'CONFIGURE A AS OUTPU
T PORT NOW
240 POKEB,PEEK(B)OR8 'TAKE OE HI
GH, CONNECT VPP
250 J=0:CLS3:PRINT@36,"NOW PROGR
AMMING LOC. $";
260 FORI=F TO L
270 PRINT@58,HEX$(I);
280 IF I>4095THENPOKEB,PEEK(B)OR
64 'SET A12 IF 4K BOUNDARY CROSS
ED
290 POKEB+1,PEEK(D+J):POKEB,PEEK
(B)OR4 'POKE DATA AND STROBE 50
MS. PULSE
300 IF(PEEK(B)AND16)=0 THEN 300
ELSE POKEB,PEEK(B)AND&HFB 'RESTO
RE PROG. PULSE STROBE WHEN 50 MS
. PULSE IS OVER
310 POKEB,PEEK(B)AND&HFE:POKEB,P
EEK(B)OR1 'ADVANCE ADDRESS
320 J=J+1:NEXT
330 POKEB,PEEK(B)AND&HF7 'REMOVE
 VPP & SET OE=0
340 CLS4:PRINT"PROGRAMMING IS CO
MPLETE."C$"INITIALIZING EPROM AD
DRESS NOW"
350 POKEB+3,0 'PORT A = INPUT
360 POKEB,PEEK(B)AND&HBF 'A12=0
370 GOSUB460
380 CLS6:PRINT"VERIFYING EPROM N
OW: LOC. $";
390 J=0:PRINT:FORI=F TO L:PRINT@
27,HEX$(I);
400 IF I>4095THENPOKEB,PEEK(B)OR
64 'SET A12 IF 4K BOUNDARY CROSS
ED
410 IF PEEK(B+1)=PEEK(D+J) THEN
420 ELSE PRINT@64,"LOCATION $";H
EX$(I);" IS #$";HEX$(PEEK(B+1))C
$"BUT  SHOULD BE #$";HEX$(PEEK(D
+J))
420 J=J+1:POKEB,PEEK(B)AND&HFE:P
OKEB,PEEK(B)OR1:NEXT
430 PRINTC$"VERIFICATION ROUTINE
 COMPLETED."C$"TURN OFF THE +25V
. SUPPLY"C$"AND REMOVE THE EPROM
."
440 POKEB,PEEK(B)AND&HDF:END 'TU
RN +5V. OFF
450 ' ADVANCE ADDRESS TO LOC. #F
460 POKEB,PEEK(B)OR3:POKEB,PEEK(
B)AND&HFD 'CLEAR ADDRESS COUNTER
470 IF FF=0 THEN 490
480 FORI=1TOFF:POKEB,PEEK(B)AND&
HFE:POKEB,PEEK(B)OR1:NEXT 'SET A
DR. CTR.=F
490 IF F<4096 THEN POKE B,33:RET
URN 'A12=0
500 POKEB,&H61:RETURN 'A12=1
```

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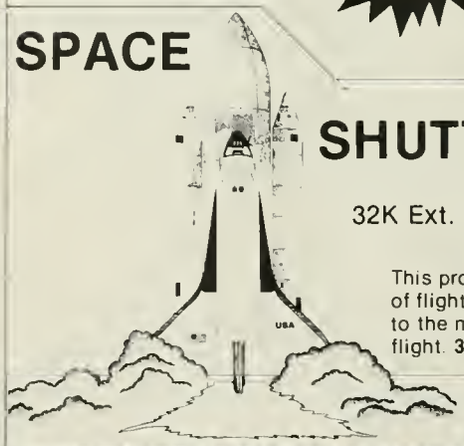

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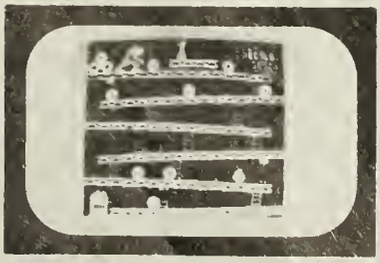

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Here's a rocket ship animation and a Mother's Day greeting.

Color Computing for Kids

by Jean Plesser

4K Color Basic

LAST MONTH WE LEARNED to use data statements. We unlocked the power of the READ command, and since then millions... well, maybe hundreds... okay, *lots* of lists have appeared on video display terminals and have rolled off printers. Data statements and you new computerists have begun to organize America! Well... books, records, addresses, telephone numbers, and other collections are a pretty good start.

This month we'll use the same commands to launch a rocket — we're going to become animators! And, for the special Mom in your life, there's an electronic Mother's Day card with a bouquet of flowers and a sing-along tune.

A Quick Review

The READ command is followed by a numeric or string variable (or variables): READ A; READ A,B; READ A$; READ A,B$,C are just some examples.

When the computer comes to a READ command it jumps to the data statements that are usually located at the end of the program. A data line contains data separated by commas, except at the end of the line. The computer reads a piece of data, stores it in the variable given in the program, and a pointer is moved to the next piece of data that will be read for the next variable or READ command. Each time a READ command is repeated, the new data replaces any data already stored in the variable. The pointer acts as a placemark; it always moves forward one piece of data at a time. The RESTORE command will send the pointer back to the first piece of data if you want to start over again.

We will be using data to set and reset specific points on the screen. If you don't have copies of screen maps from past articles, you'll find a Graphics Screen Locations map on page 278 of *Getting Started With Color Basic*. Use the screen maps to become familiar with the positions used in my programs so you'll better understand how to draw your own graphics on paper before you program them.

When you draw on a screen map, color in single rectangles when you're using a black background. But if the background is any other color, you must color an entire block of four rectangles, as outlined on the worksheet.

Let's use this information to draw a spaceship. Use the line numbers exactly as they are listed here, because we will be adding lines to the program throughout this lesson (Listing 1).

```
 10 REM***DATA DRAWN SPACESHIP***
 20 CLS 0
 50 READ H,V,C
 70 SET(H,V,C)
 80 GOTO 50
190 DATA 30,28,1,34,28,1,31,27,2
         ,33,27,2,32,26,3,32,29,4
```

Line 10 is a remark statement for the title of the program.

Line 20 clears the screen with black.

Line 50 reads a set of three data statements, storing them in variables H, V, and C.

Line 70 uses the data stored in variables H, V, and C to SET a point on the screen. H is the horizontal position, V is the vertical position and C is for the color.

Photo 1. ?OD Error

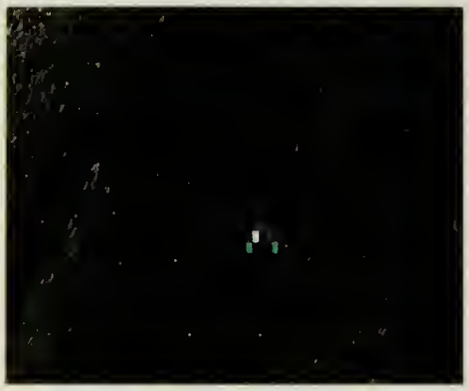


Photo 2. Rocket Without Error

Photo 3. Movement

Line 80 returns the computer to Line 50 to read another set of data.

Line 190 has 18 pieces, or six sets of data.

Now, RUN the program.

At the bottom of your screen there should be an object that looks like a tree. It isn't. That's our spaceship and you'll soon be better convinced, but first let's go over how it was made and what's going on in the green section at the top of the screen.

?OD Error???

Each colored rectangle of the spaceship was SET in a loop: Line 50 reads data, Line 70 sets a point on the screen using the data and Line 80 sends the computer back to Line 50 to SET another point. So, what happens when all the data has been read and the pointer reaches the end of Line 190? We get an ?OD ERROR message like the one at the top of your screen. This message tells you that you're out of data and you didn't tell the computer what to do when this happens (Photo 1).

LIST your program and add these lines:

```
60 IF C=4 THEN 90
90 GOTO 90
```

Now when you RUN the program your entire screen will remain black but the rocket will appear without the red rectangle below it (Photo 2). The last piece of data in Line 190 is for color 4, which is read. When C = 4, the computer will jump from Line 60 to Line 90, so the data now stored in variables H, V, and C is not used to SET a point (we'll use this data next). Line 90 creates an endless loop so you must press the BREAK key to end the program.

Rocket Fire

Let's add some life to our spaceship. Remember the red rectangle? It's going to reappear, disappear, reappear and our rocket is going to look like it's firing up for take-off. List the program and add these lines (old Line 90 gets changed):

```
90 FOR D=1 TO 50
100 SET(H,V,C)
110 RESET(H,V)
120 NEXT D
180 GOTO 180
```

Line 90 begins a FOR/NEXT loop that will repeat 50 times.

Line 100 sets a point on your screen using the data still stored in variables H, V, and C from the last READ command.

Line 110 resets the point that was set in Line 100. A color number isn't used because black is the only reset color. When a RESET command is used with a black background, the point appears to be erased.

Line 120 adds one to D and returns to Line 90. When D=50 the loop is complete and the next program line is executed.

Line 180 creates another endless loop so that a green line doesn't appear on your graphics screen. When the rocket stops firing, press the BREAK key.

Blast Off — Stage 1

Now that we've fired the rocket it's ready to blast off! The first step in animation (that's moving graphics) is to reset, or erase, the object we want to move. Add these lines to the program:

```
130 READ H,V
140 IF V=0 GOTO 170
150 RESET(H,V)
160 GOTO 130
170 GOTO 170
200 DATA 30,28,34,28,31,27,33,27
,32,26,0,0
```

Line 130 reads the new line of data we just added. This line has no color data, only position numbers.

Line 140 tests for a data code like the one we used in Line 60. This code must be different than any other data — in this case it's zero. When V=0 a jump is made to Line 170.

Line 150 — the variables H and V are the same horizontal and vertical positions that were set in Line 70. This line resets, or erases them.

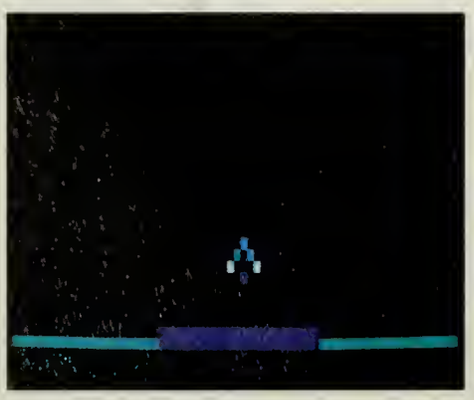
Line 160 returns to Line 130 to READ the next set of data.

Line 170 creates another endless loop, so you must hit the BREAK key. (This line will change, so, for now, ignore Line 180.) Photos 3 and 4 show movement.

Blast Off — Stage 2

To create movement, we simply need to re-draw the rocket at a different posi-

Photo 4. With A Launch Pad



tion, erase it, re-draw it, and so on. This is done by adding more data lines to be read as an outer loop repeatedly returns to Line 50.

First change Line 60 to:

```
60 IF C=4 GOTO 90 ELSE IF C=9 GO
TO 180
```

Now, add Lines 170 and Lines 210 — 270.

```
170 GOTO 50
210 DATA 30,24,5,34,24,5,31,23,6
,33,23,6,32,22,7,32,25,4
220 DATA 30,24,34,24,31,23,33,23
,32,22,0,0
230 DATA 30,20,8,34,20,8,31,19,1
,33,19,1,32,18,2,32,21,4
240 DATA 30,20,34,20,31,19,33,19
,32,18,0,0
250 DATA 30,16,6,34,16,6,31,15,7
,33,15,7,32,14,8,32,17,4
260 DATA 30,16,34,16,31,15,33,15
,32,14,0,0
270 DATA 0,0,9
```

Line 60 is a double test line. We've already used the test for C=4. Now we're checking for the end of all data, so the check for C=9, a color number that doesn't exist, will tell the computer to jump to Line 180 — an endless loop.

Line 170 is the outer loop that will send the computer back to Line 50 as long as the ELSE test in Line 60 is false.

My Final Touch

For a launch pad, add Lines 30 and 40.

```
30 FOR X=0 TO 62: SET(X,31,6): N
EXT X
40 FOR X=20 TO 43: SET(X,30,3):
NEXT X
```

These lines use the variable X in FOR/NEXT loops to draw lines across the bottom of the screen. Each time a loop repeats, one is added to X (the horizontal variable) and another point is set on the screen.

Your Final Touches

By adding more data statements you can move the rocket all the way to the top of the screen. Be sure, though, that your last line of data reads like Line 270. If you subtract four from each line of vertical data you add, the rocket will move up at the same speed.

Would you like smoother movement? Just put less space between each drawing — in this case it means less space vertically — instead of four vertical spaces away, use one or two spaces.

For faster movement, shorten the D loop in Line 90. Try FOR D=1 TO 10.

Add objects of your own to the drawing: an alien or two, more rockets, UFO's. And, for you more ambitious programmers — create bigger and better spaceships!

more

Program Listing 1. Rocketship

```
5 REM--LISTING #1
10 REM***DATA DRAWN SPACESHIP***
20 CLS 0
30 FOR X=0 TO 62: SET(X,31,6): N
EXT X
40 FOR X=20 TO 43: SET(X,30,3):
NEXT X
50 READ H,V,C
60 IF C=4 GOTO 90 ELSE IF C=9 GO
TO 180
70 SET(H,V,C)
80 GOTO 50
90 FOR D=1 TO 50
100 SET(H,V,C)
110 RESET(H,V)
120 NEXT D
130 READ H,V
140 IF V=0 GOTO 170
150 RESET(H,V)
160 GOTO 130
170 GOTO 50
180 GOTO 180
190 DATA 30,28,1,34,28,1,31,27,2
,33,27,2,32,26,3,32,29,4
200 DATA 30,28,34,28,31,27,33,27
,32,26,0,0
210 DATA 30,24,5,34,24,5,31,23,6
,33,23,6,32,22,7,32,25,4
220 DATA 30,24,34,24,31,23,33,23
,32,22,0,0
230 DATA 30,20,8,34,20,8,31,19,1
,33,19,1,32,18,2,32,21,4
240 DATA 30,20,34,20,31,19,33,19
,32,18,0,0
250 DATA 30,16,6,34,16,6,31,15,7
,33,15,7,32,14,8,32,17,4
260 DATA 30,16,34,16,31,15,33,15
,32,14,0,0
270 DATA 0,0,9
```

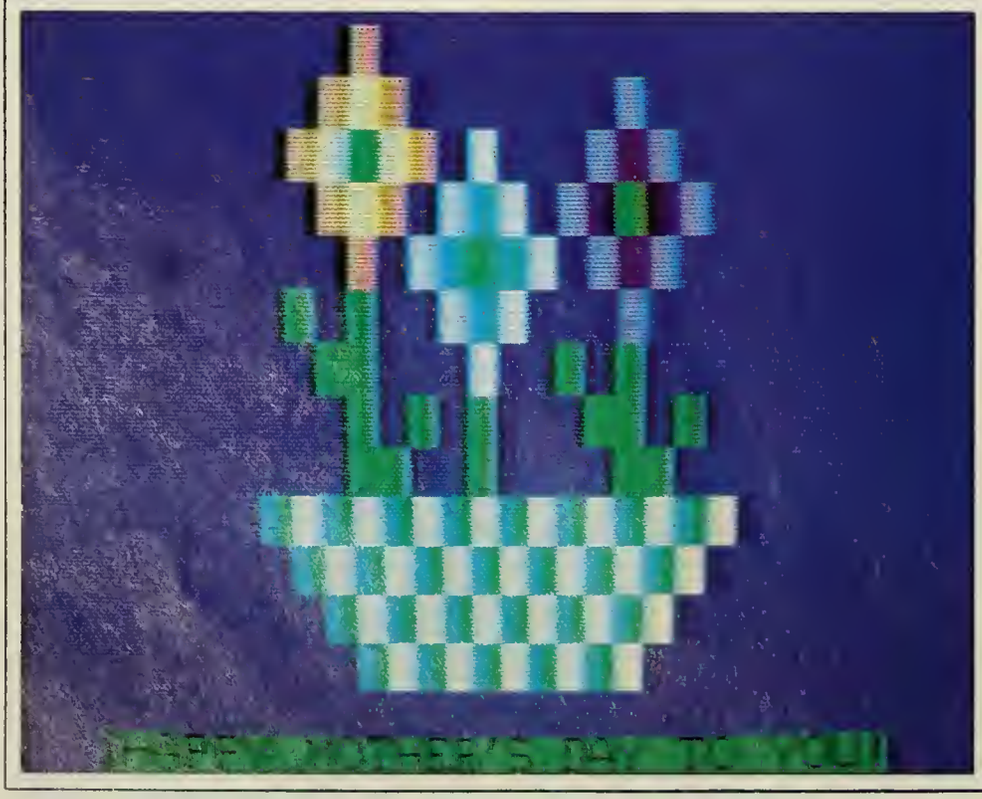
■ ■ ■

A Special Gift For Mom

May 13th is Mother's Day; Listing 2 is an electronic greeting card for the special Mom in your life. It draws a basket of flowers on the screen, then prints a message to a tune at the bottom of the screen. After each line, the message is erased before the next line is printed.

Data Lines 350 through 430 draw the flowers. Data Lines 450 through 490 combine string data (letters and spaces) with numeric data (numbers). This data is used in Line 290 to print a word, or part of one, and to sound a note.

The first number in the SOUND command is for the tone and the second number is for the length of the tone.



These numbers can be from 1 to 255.

I used quotation marks (" ") for some of the W$ data. I did this to add a blank space before a word.

We have covered all the other portions of the program in previous lessons or in this one. Follow the lines closely and perhaps you can get some help typing it in — don't forget to save it. Saving can be done in stages also, so you can type a few lines at a time. I think you'll be very pleased with the results and I know Mom will.

Here are the variable names:

A = horizontal position
B = vertical position
C = color
X = a beginning horizontal position for a loop.
Y = a beginning vertical position for a loop.
V = variable for a vertical loop.
H = variable for a horizontal loop.
W$ = string data for message.
T = data for tone in SOUND command.
S = data for sound length.

Have fun with animation and use these ideas to create electronic greeting cards for other occasions — they're great to send to other TRS-80 Color Computer owners.

Next month we'll have something special for Dad. Have a happy May! ■ ■ ■

♦ *Program*

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☎ Enter 70 on TeleResponse page 134

Program Listing 2. Mother's Day Greeting

```
10 REM--MOTHER'S DAY GREETING--
20 REM--DRAW FLOWERS--
30 CLS 3
40 READA,B,C
50 IF C=9 GOTO 90
60 SET(A,B,C)
70 GOTO 40
80 REM--DRAW BASKET--
90 X=16: Y=46
100 FOR V=20 TO 26 STEP 2
110 FOR H=X TO Y STEP 4
120 SET(H,V,6): SET(H+2,V,2)
130 NEXT H: X=X+2: Y=Y-2: NEXT V
140 REM--PRINT MESSAGE WITH SOUN
D--
150 PRINT @ 483,;
160 READ W$,T,S: IF W$="XXX" GOT
O 190
170 PRINT W$;: SOUND T,S
180 GOTO 160
190 FOR H=0 TO 62: SET(H,30,3):
NEXT H
200 PRINT @ 483,;
210 READ W$,T,S: IF W$="XXX" GOT
O 230
220 PRINT W$;: SOUND T,S: GOTO 2
10
230 FOR H=0 TO 62: SET(H,30,3):
NEXT H
240 PRINT @ 487,;
250 READ W$,T,S: IF W$="XXX" GOT
O 270
260 PRINT W$;: SOUND T,S: GOTO 2
50
270 FOR H=0 TO 62: SET(H,30,3):
NEXT H: PRINT @ 487,;
280 READ W$,T,S: IF W$="XXX" GOT
O 300
290 PRINT W$;: SOUND T,S: GOTO 2
80
300 FOR H=0 TO 62: SET(H,30,3):
NEXT H: PRINT @ 483,;
310 READ W$,T,S: IFW$="XXX" GOTO
 330
320 PRINT W$;: SOUNDT,S: GOTO 31
0
```

```
330 GOTO 330
340 REM--DATA STATEMENTS FOR FLO
WERS--
350 DATA 30,10,1,28,10,6,32,10,6
,30,8,6,30,12,6
360 DATA 30,6,5,32,8,5,34,10,5,3
2,12,5,30,14,5,28,12,5,26,10,5,2
8,8,5
370 DATA 22,6,1,22,4,2,24,6,2,22
,8,2,20,6,2
380 DATA 22,2,8,24,4,8,26,6,8,24
,8,8,22,10,8,20,8,8,18,6,8,20,4,
8
390 DATA 40,8,1,40,6,4,42,8,4,40
,10,4,38,8,4
400 DATA 40,4,7,42,6,7,44,8,7,42
,10,7,40,12,7,38,10,7,36,8,7,38,
6,7
410 DATA 22,12,1,22,14,1,22,16,1
,22,18,1,18,12,1,20,14,1,24,18,1
,26,16,1
420 DATA 30,16,1,30,18,1,40,14,1
,40,16,1,40,18,1,36,14,1,38,16,1
,42,18,1,44,16,1
430 DATA 0,0,9
440 REM--DATA STATEMENTS FOR MES
SAGE AND SOUND--
450 DATA HAP,89,5,PY,89,5," MO",
108,5,THER'S,108,5," DAY",89,10,
" TO",133,12," YOU!",125,15,XXX,
0,0
460 DATA HAP,176,5,PY,176,5," MO
",185,5,THER'S,185,5," DAY",176,
10," TO",197,12," YOU!",193,15,X
XX,0,0
470 DATA HAP,89,5,PY,89,5," MO",
108,5,THER'S,108,5," DAY",89,10,
XXX,0,0
480 DATA HAP,176,5,PY,176,5," MO
",185,5,THER'S,185,5," DAY",176,
10,XXX,0,0
490 DATA HAP,89,5,PY,89,5," MO",
108,5,THER'S,108,5," DAY",89,10,
" TO",125,10," YOU!",133,15,XXX,
0,0
500 END
```

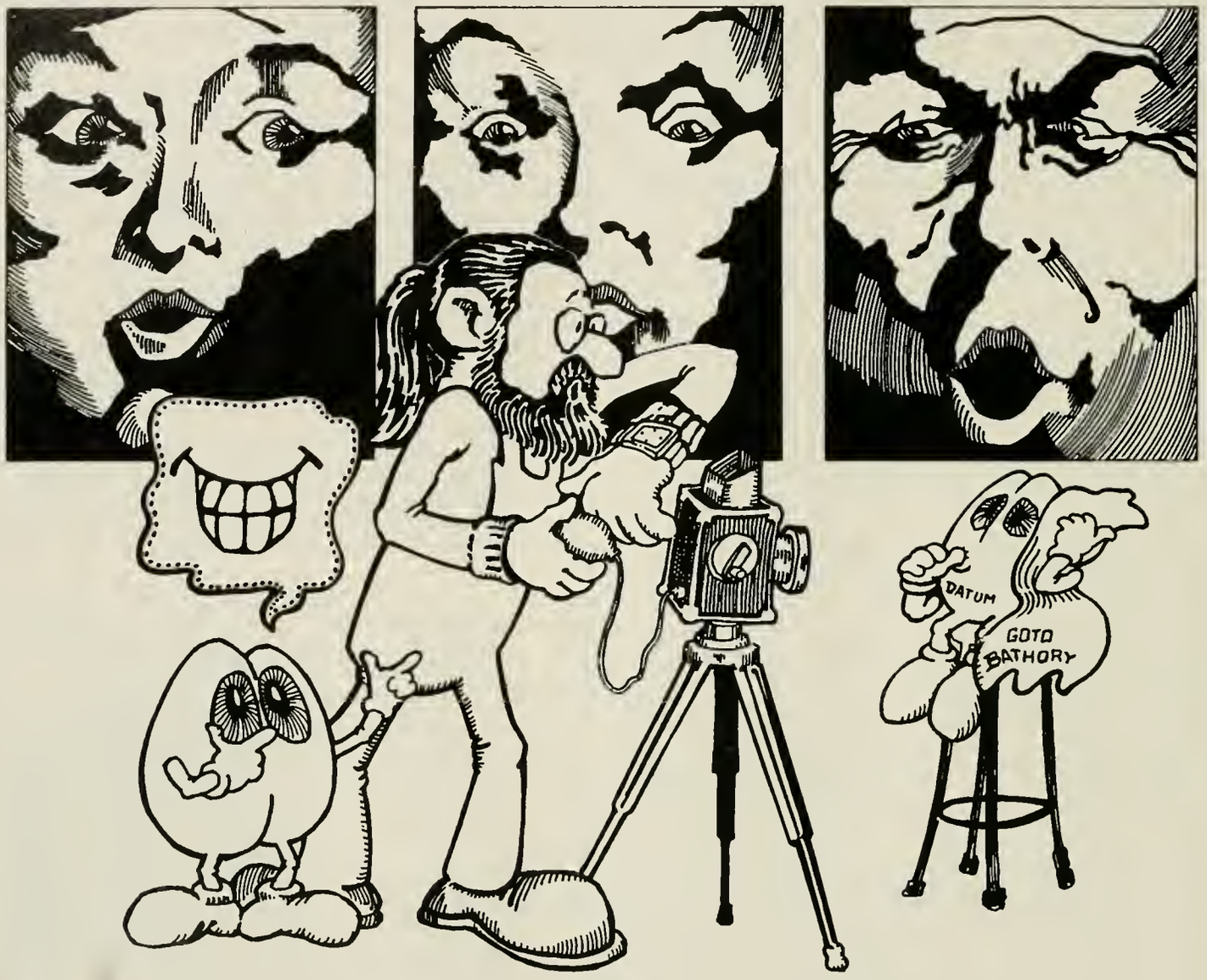
■■■

☎ Enter 24 on TeleResponse page 134

Color Burner

Part II

The conclusion to Kitsz's EPROM Burner.



16K Extended Color Basic

by Dennis Kitsz

YOU'VE ALL BEEN WAITING, so here it is! ...the software to run the Color Burner EPROM programmer, the hardware project presented in March. The listings are long, so there's not much room for me to talk (for a change).

The software consists of two parts: a Basic driver with menus and extensive "help" commands (Program Listing 1), and the assembly language read, burn and verify routines (Program Listing 2). I'll begin with the assembly language routines.

Starting at Line 240 are the values for an offset to indicate the EPROM type (more later on what that's for), the starting address to be used in the EPROM, the starting location in the computer's memory of the data to be programmed into the EPROM, and the ending address to be used in the EPROM. These values are changed by POKEs from the Basic driver.

Beginning at Line 380 are the tables of reading and programming information, based on the data presented in Table 2 (printed in March). For example, the label 02716 indicates the value to turn a 2716 EPROM off; R2716 is the value to read the EPROM; S2716 is the value to get the EPROM set to program (to turn on the programming voltage); and P2716 is the value to pulse the EPROM with a programming signal.

In these tables, the 2716, 2732, 2764 and 27128 EPROMs are defined; for other memories, four blank tables are provided, which can be filled in with the specifications for other EPROMs compatible with the Color Burner and its software.

The major subroutines begin at Line 860. Subroutine Conain configures Port A as an input from the EPROM data lines to the computer; subroutine Conaot configures Port A as an output to the EPROM data lines from the computer. Subroutine Conbcd configures Ports B, C and D as outputs to provide address and control signals to the EPROM and to the personality module. In all these configuration routines, the X register points to $FF40, the first address in the port group (the ports are addressed $FF40 through $FF47 in the Color Burner).

Speaking of the personality module, I've been asked what it's used for and why it's needed. Although it's possible to use very clever software and hardware to eliminate the need for a personality module, the module makes things plainer. The module simply routes control signals from the Color Burner to the proper connections on the EPROMs.

Power, for example, (marked Vcc) is routed to pin 24 on 2716, but goes to pin 28 on a 2764. The chip enable (CE), output enable (OE) and programming pins (Vpp and PGM) can also appear in a different order. Addresses A11, A12 and 13 are present as the EPROMs get larger. All of these have to be accommodated in the personality module and the software.

Back to the Listing. At Line 1420, the EPROM type is established for the main program. Here's where the offset (POKEd by Basic) comes into play. The X register, when offset by the A register, becomes a pointer to the correct table of EPROM information. The Y register is given that information for use in reading and burning.

Two simple subroutines are next. Line 1540 is a straightforward message display routine (message from X, to screen at Y); Line 1680 begins a delay routine (delay value in B).

At Line 1820 is a 50 mS (millisecond) delay loop, a timing critical for correctly programming EPROMs. The EPROM specifications require a precise pulse of 50 mS (.05 seconds) each time data is to be burned into the EPROM. The D register gets the value hex $18F8 (which is decimal 6328). The heart of the delay loop consisting of SUBD (Line 1840) and BNE (Line 1850) takes seven processor clock cycles. Seven clock cycles times 6328 loops is a total of 44,296 Color Computer clock cycles. Since the Color Computer runs at .89 MHz (specifically, 894,886 pulses per second), each pulse is .00000111746 seconds. Forty-four thousand, two hundred ninety-six of these pulses is .049499 seconds, or 49.499 mS. Together with the remaining pulsing and stacking instructions in this routine, the total comes out to just under 50 mS.

The subroutine at Line 1940 displays a 16-bit address as four hexadecimal digits, and its subroutine at Line 2080 is the generalized binary-to-ASCII conversion.

Doing the Programming

The main programming routine, beginning at Line 2350, displays the programmig message, configures the Color Burner ports, and points to the starting address in EPROM and in computer memory. At Line 2630, the address halves (most- and least-significant bytes) and the data are latched into the EPROM. The address and data are displayed on the screen by the routine at Line 2740.

Line 2960 begins those critical programming pulses. Interrupts are turned off, the EPROM type is identified, and a careful sequence is performed: EPROM off; short delay; EPROM on; short delay; programming voltages on; short delay; programming pulse; 50 mS delay; pulse off; short delay; voltages off; delay; EPROM off.

Following each pulse (which burns one byte into the EPROM), the address is checked for completion. If all bytes have been programmed, a message is displayed and control is returned to the Basic driver program.

Erasing, Verifying and Reading

The next assembly listing routine (Line 3540) is an erase check. EPROMs are shipped erased from the factory, and programmed EPROMs are erased under strong ultraviolet light. To be sure of a blank EPROM before programming, you need this routine. It displays its message, configures the ports (port A for input this time), selects EPROM type, points to the starting address, displays the address and the data read, and checks for an erased byte ($FF, or binary 11111111). If the EPROM is in fact erased, that message is displayed; otherwise, the erase check stops and displays an erase-fail message.

Verification of a correct EPROM programming sequence (Line 4150) is almost identical to the erase check, except that the byte read from the EPROM is compared with the bytes stored in memory. Again, the starting message is displayed, the ports are configured, the addresses are latched, and the byte is read and displayed. If the byte has not been programmed correctly, the failure message is displayed.

Reading an EPROM into memory begins at Line 4830, again following the same set-up pattern as the erase and verify checks. The difference here (Line 5200) is only that the value read from the EPROM is stored in the computer's memory for editing, tape saving or copying. The completion message is displayed and control is returned to Basic.

The remainder of the assembly listing is made up of the ASCII messages stored for display (Lines 5300–6050).

The Color Burner assembly listing is entered using EDTASM+; the comment lines (those beginning with an asterisk) are for reference and need not be typed. Save the source code to tape, and assemble the listing using the A/IM/AO command. You can use the A (assemble to tape) command with EDTASM+, or create one contiguous tape from Basic. To create a contiguous tape, quit EDTASM+ (the Q command); you will arrive in Basic. Enter CLEAR200,&H3D00, load a tape and set it to record, and enter: CSAVEM"BURNER",&H3D00, &H3FFF, &H3E3C. The Color Burner assembly language program can be used without the Basic driver, if you wish to avoid typing the 12K Basic listing. By POKEing changes into memory addresses 3D00 through 3D06, different lengths of EPROMs and amounts of programming can be established. The entry commands are: EXEC&H3DBE for the programming; EXEC&H3E3C to check for erasure; EXEC&H3E81 to verify the programming; and EXEC&H3EE6 to read an EPROM into memory.

Color Burner Basic Driver

Before loading or typing in the Basic driver, be sure to free up memory by entering PMODE0:PCLEAR1. One page of graphics memory is used.

The Basic driver main menu permits selection of EPROM type; loading, examining and saving binary code; EPROM burning and reading; and definition of new EPROMs. There is also a Help menu with brief explanations of the purpose of each command.

Here is a summary of the seven menu selections:

- Menu 1 selects an EPROM type; this action is required. Types 2716 through 27128 are built into the software; other types can be identified by choosing options five through eight. This version of the software does not support automatic adjustments to the assembly language

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In the ABC program, all 26 letters spring up in color to the familiar ABC tune. Then, colorful detailed pictures depicting each individual letter of the alphabet appear one by one. Your child's fascination will mount as he or she correctly presses the letter on the keyboard and is rewarded with a musical tune before the next detailed picture is drawn line by line onto the screen: AIRPLANE for A, BUS for B, CLOWN for C and so on to ZEBRA for Z. Truly a must program for the preschool to first grade age group!

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As the program begins, your child is presented with a nine square playing board. It is your choice as to which square you choose. After a choice is made, a MATH PROBLEM appears in the square. You score your first X by answering the problem correctly. If your answer is incorrect, the square clears and your opponent is allowed his choice of squares. The game is over when three squares vertically, horizontally, or diagonally are won by the same player. When playing against the computer, every answer you get wrong is won by the computer. Multi-level ADDITION AND SUBTRACTION program.

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FRACTIONS

SIDE ONE: Fraction Lessons, explains fractions with the aid of graphics. Child studies the different ways fractions can be represented. Lessons include:

IMPROPER FRACTIONS
MIXED FRACTIONS
PROPER FRACTIONS

Many educators have praised the use of motion and color to display the fractional equivalents.

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Joystick Draw is the simple way to explore your artistic talents! Program operation is easy enough for a child to use, but effective enough that TCE uses it to design many sophisticated high-resolution graphic screens. Joystick Draw's design allows you or your child to save those masterpieces for future revisions or for use in other programs (instructions included). Your child will spend many hours enjoying this program and at the same time improving his or her eye hand coordination! You will find Joystick Draw to be an easy way to design those more sophisticated graphics for your own programs!

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SPELL BOMBER

As captain of your ship, you must destroy the enemy bomber by spelling the mystery word. In this exciting and educational game the bomber gets closer with each inaccurate letter. You have only EIGHT tries to guess the mystery word or your ship will be bombed! If you guess the word correctly, GENERAL QUARTERS will sound and your ship will fire a missile to destroy the bomber, Three levels are available: EASY, MEDIUM, and HARD. Challenging for all ages!

Atari 16K . . . . . Tape: $18.95
CoCo 16k ECB . . . . . Tape: $18.95 Disk: $22.95
Vic 20 13k . . . . . Tape: $18.95

SPELLING BEE

The word is pronounced vocally and it is up to you to type in the correct spelling. If wrong, the computer will be your friend and flash the word on the screen for just an instant. OK! Try typing the word in again. STILL WRONG! The computer wants success and allows you to see the word again this time a little longer. If you just can't spell the word, the computer realizes you need to learn to spell the word and leaves the word on the screen for you to copy. Try your best and the computer has a surprise for your reward!

SPELLING BEE I . . . GRADE 1 & 2
SPELLING BEE II . . GRADE 3 & 4
SPELLING BEE III . . . GRADE 5 & 6
SPELLING BEE IV . . GRADE 7 & 8

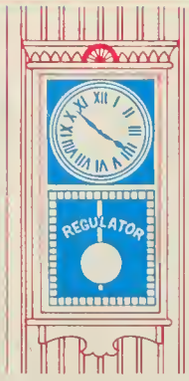
CoCo 16k ECB . . . . . TAPE: $16.95 Each

TC—INVENTORY

Many insurance companies offer a discount for policy holders which have complete inventories on file. TC – Inventory is designed to help you organize, maintain, and compile the personal belongings of your home. Program is user friendly and menu driven. TC – Inventory allows input for location of item, price of item, serial number of item, date of purchase, and a text written description of the item. Don't put off recording your personal belongings until its too late. Requires printer for hard copy.

CoCo 32k ECB . . . . . Tape: $16.95

TEACHING CLOCK



Torn between teaching time on a digital or a conventional (face and hands) clock? Well, this program combines the two using high resolution graphics and prompts! Your child will learn to tell time with the aid of a specially designed CLOCK! Child enters the time, if wrong, the center of the clock displays a graphic aid. If the child is correct a musical reward is heard. Program offers three levels: hours, quarter hours, and five minute intervals.

Apple 48k . . . . . Disk: $19.95
Atari 32k . . . . . Tape: $16.95
CoCo 16k ECB . . . Disk: $19.95 Tape: $16.95

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software for special EPROMs, so refer to my earlier description (and Part One of this project) to POKE the correct information into the programming tables.

- Menu 2 loads an object code tape into memory. The origin (starting address) for the object code software can be anywhere in memory; for use with the Color Computer's cartridges, the address range would be $C000 (decimal 49152) to $FEFF (decimal 65279). No matter what the origin, the object code is loaded into the computer's memory beginning at $4000 (16384), where it can be examined and edited. $4000 in the computer's memory represents $0000 in the final programmed EPROM.
- Menu 3 is a simple memory examination routine. One hundred twenty-eight bytes are displayed on the screen in hexadecimal. The addresses displayed are the actual addresses of the computer memory, so be careful what you edit! The Color Burner monitor can thus be used to edit any program in memory. The four keyboard arrows move a flashing cursor. Editing is done by typing hex digits; M returns the menu, and Enter places the edited screen information into memory.
- Menu 4 saves binary data to tape. You may, for example, read a known binary file and save it in edited form. Or, you may create programs or data blocks directly in memory with the editing feature, and save these to tape. Finally, you can read a known EPROM into memory and save it to tape. Like the Color Burner monitor, the tape save can be used to save any area of memory to tape.
- Menu 5 is the EPROM blasting routine itself, and should be used with care. First of all, your EPROM must already be defined as a 2716, 2732, 2764 or 27128. If it is a "special" EPROM, be sure the assembly language routine knows that's the case, by POKEing the critical information into place. You also must have the correct personality module in place. (The wiring of the four standard personality modules was presented in the first part of this article.)

There is an important order that must be followed in the programming process. First, have the board in place, then turn the power on, and load and run the Basic and assembly language listings. Execute an erase check, which properly establishes the configuration of the burner. Next, install the EPROM itself, followed by the three 9-volt batteries (be sure not to pull the board sideways when inserting the EPROM or the batteries). Then place the personality module in the socket. Finally, you can run the programming routine.

This order is important because it provides voltage to the EPROM at the proper time, and ensures that programming voltages are not present too soon, when they might damage the EPROM. Also, it is essential that the correct modules be matched to the type of EPROM you are using, and that you select the matching EPROM type from the burner software.

- Menu 6 permits the definition of a new EPROM, in this case, the creation of a proper personality module. After answering a series of questions about the new EPROM, you will be shown a diagram of the wiring necessary to produce a personality module. Note that if two wires connect to the same point on the right side of the header, choose either one — but not both — and take that into account when creating the table information for that EPROM in the assembly listing.
- Menu 7 reads an EPROM into memory. Once again, the EPROM must be defined correctly to be read from the Color Burner. The information from the EPROM will be read into the computer's memory beginning at address $4000 (16384).

What to Expect

The Color Burner isn't the most convenient piece of hardware to use, but it is the most economical to put together. Its power supply (three 9-volt alkaline bateries) wears down after programming only a few dozen EPROMs, and they are a little clumsy to install (if you're clumsy like me).

And since the Color Burner only programs one EPROM at a time, you'll have to wait quite a while to burn two or three 27128 EPROMs at about 15 minutes each. Last of all, remember never to press Reset or turn off the computer's power when programming is in progress, since it may result in damage to the EPROM or to the Color Burner.

Enjoy the Color Burner; it is a reliable and economical EPROM burner for your Color Computer.

Updates

In Part I, the hardware portion of this project (March), Tables 1 and 2 and Figure 3 had some minor errors. The alignment was incorrect in Table 1; it should look like Correction Table 1.

In the schematic presented in Part I, address line A2 was shown going to the upper 6821 CS1, and through a 7406 inverter to the lower 6821 CS1. The order should have been reversed: A2 goes to the lower 6821 CS1, and through an inverter to the upper 6821 CS1.

In Table 2, the 2716 pulse line should have read:

1 0 0 1 (0) (0) 010 1 = $90,$91,$90

Finally, in Figure 3, A12 was shown twice in the 27128 header. The order of signals on the right side of the header should be: Vpp, A12, Vcc, PGM, A13, A11, OE, CE.

■ ■ ■

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0V	5V	21V	25V	—	PGM*	CE*	DE*

Programming/Reading Voltages (V_{pp}):				Control/Select Lines:		
0 = 0	0 = Z	0 = Z	0 = Z	2764	All	2716
1 = Z	1 = 5V	1 = 21V	1 = 25V	27128		2764
(Z = transitor turned off)						27128

Correction Table 1. Port $FF46 Realigned

Program Listing 1. Basic Driver

```
2 PMODE0:PCLEAR1:CLEAR200,&H3D00
:A=128:A$=STRING$(32,A):B$=STRIN
G$(9,A):C$=STRING$(3,A):D$=CHR$(
A):XP=&H3DBE:XE=&H3E3C:XV=&H3E81
:XR=&H3EE6:FORX=0TO8:READE$(X):N
EXT:DATANONE,2716,2732,2764,2712
8,SPCL1,SPCL2,SPCL3,SPCL4
4 DIMD(28):FORX=0TO28:READD(X):N
EXT:DATA0,25,45,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,165,0,145,125,
0,0,105,85,65
```

```
6 GOSUB14:GOSUB16
8 GOSUB46:IFX$="H"ORX$="h"THEN48

10 ONVAL(X$)GOTO126,136,168,234,
250,278,346
12 GOTO8
14 CLS0:PRINT@0,A$"Color Burner
Monitor/Blaster 1.0Copyright (c)
 1984   D. B. Kitsz"A$;:RETURN
16 PRINT@128,B$" >>> MENU <<< "B
$A$C$" 1.  Set EPROM type.
"C$C$" 2.  Load object tape.
"C$C$" 3.  Examine object code.
"C$C$" 4.  Save object tape.
"C$C$" 5.  Blast EPROM.
"C$;
18 PRINTC$" 6.  Define new EPROM
.    "C$C$" 7.  Read EPROM progr
am.  "C$A$" Touch number or "CHR
$(34)"H"CHR$(34)"  for HELP.";ST
RING$(31,A);:POKE1535,A:RETURN
20 PRINT"Starting Address (Hexad
ecimal):":INPUT"Address ---->";M
$:MM=VAL("&H"+M$)
22 PRINT"Ending Address (Hexadec
imal):":INPUT"Address ---->";N$:
NN=VAL("&H"+N$)
24 IFE=0THEN42ELSEIFE<5THENEE=10
24*2^E
26 IFE>4THENEE=1024*2^EX
28 IFNN>EE THEN38
30 MS=INT(MM/256):MT=MM-256*MS
32 NS=INT(NN/256):NT=NN-256*NS
34 POKE&H3D00,E-1:POKE&H3D01,MS:
POKE&H3D02,MT:POKE&H3D05,NS:POKE
&H3D06,NT
36 RETURN
38 PRINT"Program length exceeds
size of  EPROM.  Please indicate
 correct size of EPROM (Use Menu
 #1).    Press <ENTER> to return
 Menu.  ";:POKE1535,96
40 GOSUB46:QQ=1:RETURN
42 PRINT"EPROM not defined (Use
Menu #1).Press <ENTER> to return
 Menu.   ";
44 GOSUB46:QQ=1:RETURN
46 X$=INKEY$:IFX$=""THEN46ELSERE
TURN
48 GOSUB14:PRINTA$C$" HELP is av
ailable for... "C$A$C$"1. Settin
g EPROM type.    "C$C$"2. Loadin
g object code.   "C$C$"3. Examin
ing object code. "C$C$"4. Saving
 object code.    "C$C$"5. Blasti
ng an EPROM.     "C$;
```

```
50 PRINTC$"6. Defining a new EPR
OM.  "C$C$"7. Reading an EPROM.
     "C$A$" Touch number or "CHR
$(34)"M"CHR$(34)" for MENU. ";
52 GOSUB46:IFX$="M"ORX$="m"THEN6

54 ONVAL(X$)GOTO58,64,76,84,90,1
08,120
56 GOTO52
58 CLS0:PRINTD$C$" 1.  SETTING E
PROM TYPE "D$C$A$"You must defin
e the type EPROM  you are using
before it can be  programmed.  T
his software will program four s
tandard types of  EPROMs:  2716
(2K), 2732 (4K),  2764 (8K) and
27128 (16K).  For ";
60 PRINT"other types of EPROMs,
an EPROM definition menu is prov
ided (seeSelection #6).  To prog
ram any  EPROM correctly, its re
spective personality module is p
lugged   into the Color Burner.
         Touch M to return the M
enu.     ";
62 GOSUB46:IFX$="M"ORX$="m"THEN6
ELSE62
64 CLS0:PRINTD$C$" 2. LOADING OB
JECT CODE "D$C$A$"Object code is
 the binary code  burned into th
e EPROM.  The codeis prepared wi
th a monitor or aneditor/assembl
er, and saved in  binary format
for use with the  BASIC CLOADM c
ommand. The binary";
66 PRINT"code must have its orig
in (ORG) specified where you exp
ect it toappear in the final EPR
OM.  The ORG for Color Computer
ROM packsis $C000 (49152).
         Touch M for Menu, C to
Continue.";
68 GOSUB46:IFX$="M"ORX$="m"THEN6
ELSEIFX$="C"ORX$="c"THEN70ELSE68

70 CLS0:PRINTD$C$" 2. LOADING OB
JECT CODE "D$C$A$"You can also u
se Color Burner's hex monitor to
 prepare object   code.  The mem
ory range of the  monitor is hex
adecimal 4000 to  7FFF, which re
presents 0000 to  3FFF in the fi
nal EPROM.  The   ";
72 PRINT"final option for loadin
g object code is by copying the
contents of a programmed EPROM.
```

```
 You willbe prompted to insert a
nd removethe original and blank
EPROMs.  Touch M for Menu, R to
repeat.  ";
74 GOSUB46:IFX$="R"ORX$="r"THEN6
4ELSEIFX$="M"ORX$="m"THEN6ELSE74

76 CLS0:PRINTD$C$" 3. EXAMINE OB
JECT CODE "D$C$A$"Object code is
 the binary data  which will be
burned into the   EPROM.  It can
 be a program or  tables or othe
r information. TheColor Burner m
onitor displays   the binary dat
a in hexadecimal  ";
78 PRINT"format.  Move the curso
r with   the four keyboard arrow
s.  Placethe cursor over the byt
es you   wish to edit.  After co
mpleting any changes, press ENTE
R.  The  prompt will ask for con
firmationof the changes.
         ";
80 PRINT"Press M to return to th
e Menu  ";:POKE1535,96
82 GOSUB46:IFX$="M"ORX$="m"THEN6
ELSE82
84 CLS0:PRINTD$C$" 4.  SAVING OB
JECT CODE "D$C$A$"After creating
 or editing the   binary object
code, you may wishto save it to
tape.  This editedobject code wi
ll be saved using the address $4
000, where it has been stored in
 the Color Burner ";
86 PRINT"memory buffer.  When re
loading  edited Color Burner cod
es, you  MUST specify $4000 as t
he origin(ORG) address.
         Touch M to return the M
enu.     ";
88 GOSUB46:IFX$="M"ORX$="m"THEN6
ELSE88
90 CLS0:PRINTD$C$" 5.  BLAST (BU
RN) EPROM "C$D$A$"To burn an EPR
OM, you must be   certain that y
ou have correctly followed two i
nstructions:      1.  You must h
ave defined the       EPROM you
are burning.      2.  You must h
ave inserted the  ";
92 PRINT"    correct personality
 module       in the socket on th
e Color       Burner.
         If you have not defined
 your    EPROM, the software wil
l ask youto do so.
```

```
          Touch M for Menu, C to
Continue.";
94 GOSUB46:IFX$="M"ORX$="m"THEN6
ELSEIFX$="C"ORX$="c"THEN96ELSE94

96 CLS0:PRINTD$C$" 5.  BLAST (BU
RN) EPROM "C$D$A$"You are respon
sible for using   the correct pe
rsonality module. USING THE INCO
RRECT MODULE MAY  PERMANENTLY DA
MAGE THE EPROM!   Refer to your
manual if you are unsure of how
to insert the     ";
98 PRINT"personality modules.  I
t is bestto insert the personali
ty modulebefore beginning your p
rogram-  ming session.  If you c
hange    modules under power, do
 not pullthe Color Burner sidewa
ys.      Touch M for Menu, C to
Continue.";
100 GOSUB46:IFX$="M"ORX$="m"THEN
6ELSEIFX$="C"ORX$="c"THEN102ELSE
100
102 CLS0:PRINTD$C$" 5.  BLAST (B
URN) EPROM "C$D$A$"The prompt wi
ll indicate when toinsert the EP
ROM.  DO THIS ONLY WHEN PROMPTED
, and DO IT SLOWLY AND CAREFULLY
, OR YOU MAY DAMAGEBOTH EPROM AN
D COMPUTER!  Refer to your manua
l to identify which";
104 PRINT"way to insert the EPRO
M in the  socket.  NEVER PRESS R
ESET OR   TURN OFF THE POWER WHE
N PROGRAM-MING IS IN PROGRESS!
You may   BREAK, but programming
 will stopat that point.
          Press M for Menu, R to
 Repeat.  ";
106 GOSUB46:IFX$="M"ORX$="m"THEN
6ELSEIFX$="R"ORX$="r"THEN90ELSE1
06
108 CLS0:PRINTD$C$" 6.  DEFINE A
 NEW EPROM "C$D$A$"To define a n
ew EPROM, you need the specifica
tions of the EPROM and an unders
tanding of how to  read them.  Y
ou will be asked todefine each p
in of the EPROM, tospecify progr
amming voltages,   ";
110 PRINT"and to indicate the pr
ogramming pulse time.  You will
also need to describe the size (
number of bytes) of the EPROM.
          Touch M for Menu, C to
 Continue.";
```

```
112 GOSUB46:IFX$="M"ORX$="m"THEN
6ELSEIFX$="C"ORX$="c"THEN114ELSE
112
114 CLS0:PRINTD$C$" 6.  DEFINE A
 NEW EPROM "C$D$A$"When the EPRO
M is defined, you  will be asked
 if a personality  module has be
en created.  If youneed the info
rmation, a wiring  diagram will
be displayed.  Do  not continue
unless the module  ";
116 PRINT"has been wired and is
in place  on the Color Burner.
Refer to  your documentation for
 EPROMs   not included in this s
oftware.  Touch M for Menu, R to
 Repeat.  ";
118 GOSUB46:IFX$="M"ORX$="m"THEN
6ELSEIFX$="R"ORX$="r"THEN108ELSE
118
120 CLS0:PRINTD$C$" 7.  READING
AN EPROM   "C$D$A$"To read an al
ready programmed   EPROM, you ne
ed to define its   size (Menu #1
).  After defining the size, ind
icate the start andending addres
ses of the EPROM tobe read into
memory.  The data  ";
122 PRINT"will be read quickly i
nto the   memory, where it can b
e examinedand edited.
          Touch M to return to t
he Menu.  ";
124 GOSUB46:IFX$="M"ORX$="m"THEN
6ELSE124
126 GOSUB14
128 PRINT" <*> EPROM DEFINED = "
E$(E)" <*>"
130 PRINTA$C$"1.  2716 (2K X 8)
        "C$C$"2.  2732 (4K X 8)
        "C$C$"3.  2760 (8K X 8)
        "C$C$"4.  27128 (16K X 8
)       "C$C$"5.  SPECIAL (MENU
#6)     "C$A$"  Touch number or
"CHR$(34)"M"CHR$(34)" for Menu.
";
132 GOSUB46:IFX$="M"ORX$="m"THEN
6ELSEIFX$<"1"ORX$>"8"THEN132
134 E=VAL(X$):GOTO126
136 GOSUB14
138 PRINT"  <*> OBJECT CODE LOAD
ING <*>   "A$;
140 IFE=0THENPRINT"YOUR EPROM HA
S NOT BEEN DEFINED.PLEASE USE ME
NU SELECTION #1.":FORN=1TO2000:N
EXT:GOTO6
142 PRINT"What is the origin of
the objectcode on the tape?"
144 INPUT"Enter a hexadecimal va
lue from  $0000 to $FFFF ----->"
;O$
146 O=VAL("&H"+O$)
148 PRINT"Where in your "E$(E)"
EPROM is thisobject code to be l
oaded?"
150 INPUT"Enter a hexadecimal va
lue from  $0000 to $FFFF ----->"
;P$
152 PRINT"Insert tape and touch
L to load,M to return the Menu.
        ";:POKE1535,96
154 GOSUB46:IFX$="M"ORX$="m"THEN
6ELSEIFX$="L"ORX$="l"THEN156ELSE
154
156 GOSUB14:PRINT"  <*> OBJECT C
ODE LOADING <*>   "A$;
158 PRINT"Enter the filename of
the objectcode; if not known, hi
t ENTER."
160 INPUT"Filename ----->";F$
162 IFF$=""THENF$=" "
164 CLOADM F$,O-P
166 PRINT"Object Code Loaded.":F
ORN=1TO1000:NEXT:GOTO6
168 GOSUB14
170 PRINT"   <*> MEMORY EXAMINAT
ION <*>   "A$;
172 PRINT"Starting Address (Hexa
decimal):":INPUT"Address ---->";
M$:MM=VAL("&H"+M$):CLS:FORN=1TO1
6
174 AD$=HEX$(MM):IFLEN(AD$)<4THE
NAD$=STRING$(4-LEN(AD$),"0")+AD$

176 PRINTAD$" **";:FORT=0TO7
178 DD=PEEK(MM+T):DD$=HEX$(DD):I
FLEN(DD$)<2THENDD$="0"+DD$
180 PRINT" "DD$;:NEXT
182 IFN<16THENPRINT" ";
184 MM=MM+8:NEXT
186 Z=1032
188 Z1=PEEK(Z):POKEZ,A
190 X$=INKEY$:IFX$=""THENPOKEZ,Z
1:GOTO188
192 IFX$=CHR$(8)THENPOKEZ,Z1:GOT
O210
194 IFX$=CHR$(9)THENPOKEZ,Z1:GOT
O216
196 IFX$=CHR$(10)THENPOKEZ,Z1:GO
TO222
198 IFX$=CHR$(94)THENPOKEZ,Z1:GO
TO224
```

An Important Bulletin for Home Computer Users

This is the only programming system you'll ever need for your home computer.

If you own a small home computer, the story we're about to tell you could be of great help. It's about a revolutionary new software programming system that will let you and your entire family take full advantage of that machine you bought. But first things first, so here's a list of the home computers this product was specifically designed for: Atari 400, 600, 800, XL Series; Commodore Pet, VIC 20 and 64; IBM PCjr; TRS-80 color computer; TI-99/4A and the Timex Sinclair 1000, 2048 and 2068. If you own one of these computers, it would be well worth your time to read further.

THE PROBLEM WITH HOME COMPUTERS

As you probably know, the problem with these small computers is how to get good software into them. Keyboard entry is too time consuming. Diskettes do the job well, but the loaders are expensive and so are the diskettes. Cassette loading is less expensive, but the cassettes themselves still aren't cheap and sometimes a program has to be read again and again before it actually is entered. Furthermore, few of these software manufacturers guarantee their product to run at all.

So unfortunately, a lot of these potentially useful computers are relegated to just game-playing or, even worse, they find their way onto a closet shelf somewhere behind the bowling ball or last year's magazines.

THE SOLUTION IS DATABAR SOFTWARE

Now, thanks to the engineers at Databar Corporation, you can bring your computer back to life. They have developed OSCAR—which stands for an Optical Scanning Reader. What it does is read a bar code program in much the same manner as your local supermarket reads the bar code information on your grocery products. OSCAR plugs directly into your computer, and can read even complex programs extremely fast. In fact, in a recent time test it took a graduate computer programmer 1 hour, 9 minutes and 43 seconds to successfully type-in a program. To enter that same program, it took an eight-year-old child with no computer experience only eight minutes and 17 seconds.

With OSCAR, programming is also inexpensive. The bar code programs read by OSCAR are printed on paper, making the programs inherently a lot less costly to produce than cassette tapes or diskettes. And because the programs cost less to produce, they can be sold to you for significantly less.

But, just because they cost less doesn't mean they aren't of the highest quality. In fact, they are so good and reliable, we are almost alone among software manufacturers to guarantee our product to run as advertised.

Databar Corporation has already developed an extensive library of programs ranging in subject matter from non-violent games to science, health, home management, writing skills and more. These programs are readily available at your local computer store and they retail for under $10 (about 1/3 what a diskette costs).

THE DATABAR CLUB

But amazingly, you can get great software programs for an unbelievable $1.25 each—if you choose to join the Databar Club. Every charter member gets 12 monthly issues of the Databar magazine each featuring at least eight great programs. In addition, this family oriented magazine also features articles on related subjects and computer use in general. The subjects covered by the software include: games, home management, classroom learning, health, law, science, writing skills, and computer programming. What's more, Databar Club members get a three-ring binder for their software programs as well as eligibility for exciting contests.

But whether you join the Databar Club or purchase individual program packages from your favorite retailer—OSCAR can dramatically change the amount and quality of the use you get out of your computer. And let's face it: in the not so distant future much of an individual's competence will be tied up in how well he or she interfaces with a computer.

This trial offer includes OSCAR plus the premier issue of Databar magazine. OSCAR is backed by a full 1-year warranty and if you aren't 100% satisfied with OSCAR, then you can return the unit within 30 days for a full refund.

To order, credit card holders call toll free and ask for OSCAR, or send a check plus $1.50 for shipping and handling for each unit ordered.

OSCAR with the premier issue of Databar magazine can be yours for only $79.95. And the premier edition of Databar magazine provides all details necessary for joining the Databar Club. So send for your OSCAR today—and take full advantage of your computer tomorrow.

☐ **Option 1 ($79.95)†•††** OSCAR—a professional quality optical reader for easy programming of your home computer in minutes, plus a trial copy of DATABAR Magazine.

☐ **Option 2 ($120.00)** Charter Member DATABAR Club 1-year subscription to DATABAR Magazine—with 8 programs every issue.

☐ **Option 3 ($35.00 Q1)** Same as Option 2 but payable $35 per quarter.

☐ **Option 4 ($240.00)†** Charter Member DATABAR Club 2-year subscription to DATABAR Magazine—with a FREE OSCAR, the industry's finest barcode programmer

☐ **Option 5 ($10.50)** Trial copy of DATABAR Magazine—chuck-full of barcode programs.

•30-day money-back guarantee. †Add $1.50 for handling ††MN residents add 6% sales tax

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Databar Corporation, 10202 Crosstown Circle • Eden Prairie, MN 55344 • Phone Orders: MN (612) 944-5700
Out-of-State: 1 (800) 672-2776

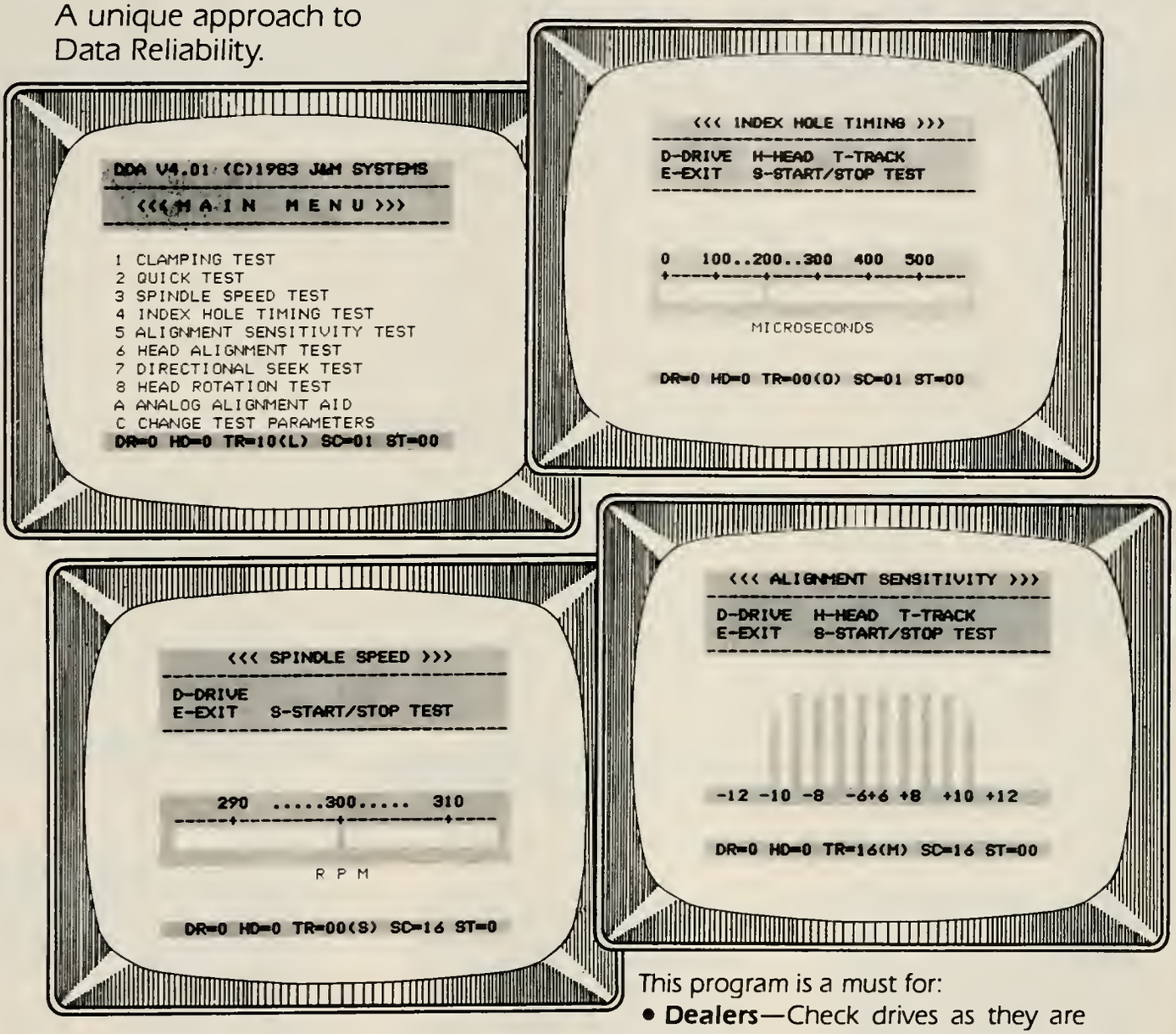
☎ Enter 19 on TeleResponse page 134

```
200 IFX$=CHR$(13)THENPOKEZ,Z1:GO
TO226
202 IFX$="M"ORX$="m"THEN6
204 IFX$>="0"ANDX$<="9"THENZ1=AS
C(X$)+64
206 IFX$>="A"ANDX$<="F"THENZ1=AS
C(X$)
208 POKEZ,Z1:GOTO216
210 ZQ=(Z-1024)AND31:IFZQ<9THEN1
88
212 IFZQ=9ORZQ=12ORZQ=15ORZQ=18O
RZQ=21ORZQ=24ORZQ=27ORZQ=30THENZ
=Z-1ELSEZ=Z-2
214 GOTO188
216 ZQ=(Z-1024)AND31:IFZQ>29THEN
188
218 IFZQ=8ORZQ=11ORZQ=14ORZQ=17O
RZQ=20ORZQ=23ORZQ=26ORZQ=29THENZ
=Z+1ELSEZ=Z+2
220 GOTO188
222 IFZ>1504THEN188ELSEZ=Z+32:GO
TO188
224 IFZ<1056THEN188ELSEZ=Z-32:GO
TO188
226 MM=MM-128:Z=1024:FORN=1TO16:
FORT=8TO29STEP3:Z1=PEEK(T+Z):IFZ
1>111THENZ1=Z1-64
228 Z2=PEEK(T+Z+1):IFZ2>111THENZ
2=Z2-64
230 DD=VAL("&H"+CHR$(Z1)+CHR$(Z2
)):POKEMM,DD:MM=MM+1:NEXT:Z=Z+32
:NEXT
232 GOTO6
234 GOSUB14
236 PRINT"   <*> SAVING OBJECT C
ODE <*>   ";A$;
238 GOSUB20:IFQQ=1THENQQ=0:GOTO6

240 PRINTA$;"Load tape and set t
o record.    Press S to Save, M
for the Menu.";
242 GOSUB46:IFX$="S"ORX$="s"THEN
244ELSEIFX$="M"ORX$="m"THEN6ELSE
242
244 CLS0:PRINT@256,"";:INPUT"Ent
er Filename ---->";F$
246 CSAVEM F$,MM+&H4000,NN+&H400
0,MM+&H4000 :GOTO6
248 GOTO248
250 GOSUB14
252 PRINT"    <*> BURNING AN EPR
OM <*>    ";A$;
254 PRINT"Do you wish to verify
erasure? Touch Y for yes, N for no."
256 GOSUB46:IFX$="Y"ORX$="y"THEN
258ELSEIFX$="N"ORX$="n"THEN264EL
SE256
258 CLS:EXEC XE
260 PRINT@256,"Press C to Contin
ue, M for Menu"
262 GOSUB46:IFX$="C"ORX$="c"THEN
264ELSEIFX$="M"ORX$="m"THEN6ELSE
262
264 CLS:GOSUB14:GOSUB20:IFQQ=1TH
ENQQ=0:GOTO6
266 CLS:EXECXP
268 PRINT@256,"PROGRAMMING IS CO
MPLETE.":PRINT"Do you wish burn
verification?  (Touch Y for yes,
 N for no)";
270 GOSUB46:IFX$="Y"ORX$="y"THEN
272ELSEIFX$="N"ORX$="n"THEN6ELSE
270
272 CLS:EXEC XV
274 PRINT@256,"Press "CHR$(34)"M
"CHR$(34)" to return the Menu."
276 GOSUB46:IFX$="M"ORX$="m"THEN
6ELSE276
278 GOSUB14
280 PRINT"  <*> DEFINING A NEW E
PROM <*>  ";A$;
282 INPUT"How many pins (24 or 2
8)";D1:IFD1<>24ANDD1<>28THEN282
284 INPUT"Program voltage (21 or
 25)";D2:IFD2<>21ANDD2<>25THEN28
4
286 INPUT"Power (Vcc) on what pi
n";D3:IFD3>D1 THEN282
288 INPUT"Program (Vpp) on what
pin";D4:IFD4>D1 THEN 282
290 INPUT"Lo OE what pin (0 if n
o OE)";D5:IFD5>D1 THEN282
292 INPUT"Lo CE what pin (0 if n
o CE)";D6:IFD6>D1 THEN282
294 INPUT"A11 what pin (0 if no
A11)";D7:IFD7>D1 THEN282
296 INPUT"A12 what pin (0 if no
A12)";D8:IFD8>D1 THEN282
298 INPUT"A13 what pin (0 if no
A13)";D9:IFD9>D1 THEN282
300 INPUT"Lo PGM what pin (0 if
no PGM)";DA:IFDA>D1 THEN282
302 PCLS:SCREEN1,1:LINE(80,10)-(
180,180),PSET,B:LINE(120,10)-(14
0,10),PRESET
304 CIRCLE(130,10),10,3,1,0,.5
306 FORN=1TO8:CIRCLE(90,5+N*20),
5,3:CIRCLE(170,5+N*20),5,3:NEXT
```

Disk Drive Analyzer

A unique approach to
Data Reliability.



In 30 seconds this program will make the following tests while drives are in your computer.

- Head Alignment
- Motor Speed
- Index Hole Timing
- Azimuth
- Hysteresis

This program may be used to help align your drives without costly test equipment.

To Order, Call: **(505) 265-1501**

This program is a must for:

- **Dealers**—Check drives as they are received. Save time and money on service contracts by quickly isolating drive problems.
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$79—Single Sided
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Terms, COD Cash or Cashier's Check, Visa, MasterCard. Add $3.00 for shipping in continental United States.

J & M SYSTEMS, LTD.

137 Utah NE • Albuquerque New Mexico 87108 • (505) 265-5072 • (505) 265-1501

☎ Enter 69 on TeleResponse page 134

Telewriter-64™

the Color Computer Word Processor

- **3 display formats: 51/64/85 columns × 24 lines**
- **True lower case characters**
- **User-friendly full-screen editor**
- **Right justification**
- **Easy hyphenation**
- **Drives any printer**
- **Embedded format and control codes**
- **Runs in 16K, 32K, or 64K**
- **Menu-driven disk and cassette I/O**
- **No hardware modifications required**

THE ORIGINAL

Simply stated, Telewriter is the most powerful word processor you can buy for the TRS-80 Color Computer. The original Telewriter has received rave reviews in every major Color Computer and TRS-80 magazine, as well as enthusiastic praise from thousands of satisfied owners. And rightly so.

The standard Color Computer display of 32 characters by 16 lines without lower case is simply inadequate for serious word processing. The checkerboard letters and tiny lines give you no feel for how your writing looks or reads. Telewriter gives the Color Computer a 51 column by 24 line screen display with *true lower case characters*. So a Telewriter screen looks like a printed page, with a good chunk of text on screen at one time. In fact, more on screen text than you'd get with Apple II, Atari, TI, Vic or TRS-80 Model III.

On top of that, the sophisticated Telewriter full-screen editor is so simple to use, it makes writing fun. With single-letter mnemonic commands, and menu-driven I/O and formatting, Telewriter surpasses all others for user friendliness and pure power.

Telewriter's chain printing feature means that the size of your text is never limited by the amount of memory you have, and Telewriter's advanced cassette handler gives you a powerful word processor without the major additional cost of a disk.

...one of the best programs for the Color Computer I have seen...
— Color Computer News, Jan. 1982

TELEWRITER-64

But now we've added more power to Telewriter. Not just bells and whistles, but major features that give you total control over your writing. We call this new supercharged version Telewriter-64. For two reasons.

64K COMPATIBLE

Telewriter-64 runs fully in any Color Computer — 16K, 32K, or 64K, with or without Extended Basic, with disk or cassette or both. It automatically configures itself to take optimum advantage of all available memory. That means that when you upgrade your memory, the Telewriter-64 text buffer grows accordingly. In a 64K cassette based system, for example, you get about 40K of memory to store text. So you don't need disk or FLEX to put all your 64K to work immediately.

64 COLUMNS (AND 85!)

Besides the original 51 column screen, Telewriter-64 now gives you 2 additional high-density displays: 64 × 24 and 85 × 24!! Both high density modes provide all the standard Telewriter editing capabilities, and you can switch instantly to any of the 3 formats with a single control key command.

The 51 × 24 display is clear and crisp on the screen. The two high density modes are more crowded and less easily readable, but they are perfect for showing you the exact layout of your printed page, *all on the screen at one time*. Compare this with cumbersome "windows" that show you only fragments at a time and don't even allow editing.

RIGHT JUSTIFICATION & HYPHENATION

One outstanding advantage of the full-width screen display is that you can now set the screen width to match the width of your printed page, so that "what you see is what you get." This makes exact alignment of columns possible and it makes hyphenation simple.

Since short lines are the reason for the large spaces often found in standard right justified text, and since hyphenation is the most effective way to eliminate short lines, Telewriter-64 can now promise you some of the best looking right justification you can get on the Color Computer.

FEATURES & SPECIFICATIONS:

Printing and formatting: Drives any printer (LPVII/VIII, DMP-100/200, Epson, Okidata, Centronics, NEC, C. Itoh, Smith-Corona, Terminet, etc).

Embedded control codes give full dynamic access to intelligent printer features like: underlining, subscript, superscript, variable font and type size, dot-graphics, etc.

Dynamic (embedded) format controls for: top, bottom, and left margins; line length, lines per page, line spacing, new page, change page numbering, conditional new page, enable/disable justification.

Menu-driven control of these parameters, as well as: pause at page bottom, page numbering, baud rate (so you can run your printer at top speed), and Epson font. "Typewriter" feature sends typed lines directly to your printer, and Direct mode sends control codes right from the keyboard. Special Epson driver simplifies use with MX-80.

Supports single and multi-line headers and automatic centering. Print or save all or any section of the text buffer. Chain print any number of files from cassette or disk.

File and I/O Features: ASCII format files — create and edit BASIC, Assembly, Pascal, and C programs, Smart Terminal files (for uploading or downloading), even text files from other word processors. Compatible with spelling checkers (like Spell 'n Fix).

Cassette verify command for sure saves. Cassette auto-retry means you type a load command only once no matter where you are in the tape.

Read in, save, partial save, and append files with disk and/or cassette. For disk: print directory with free space to screen or printer, kill and rename files, set default drive. Easily customized to the number of drives in the system.

Editing features: Fast, full-screen editor with wordwrap, block copy, block move, block delete, line delete, global search and replace (or delete), wild card search, fast auto-repeat cursor, fast scrolling, cursor up, down, right, left, begin line, end line, top of text, bottom of text; page forward, page backward, align text, tabs, choice of buff or green background, complete error protection, line counter, word counter, space left, current file name, default drive in effect, set line length on screen.

Insert or delete text anywhere on the screen without changing "modes." This fast "free-form" editor provides maximum ease of use. Everything you do appears immediately on the screen in front of you. Commands require only a single key or a single key plus CLEAR.

...truly a state of the art word processor... outstanding in every respect.
— The RAINBOW, Jan. 1982

PROFESSIONAL WORD PROCESSING

You can no longer afford to be without the power and efficiency word processing brings to everything you write. The TRS-80 Color Computer is the lowest priced micro with the capability for serious word processing. And only Telewriter-64 fully unleashes that capability.

Telewriter-64 costs $49.95 on cassette, $59.95 on disk, and comes complete with over 70 pages of well-written documentation. (The step-by-step tutorial will have your writing with Telewriter-64 in a matter of minutes.)

To order, send check or money order to:

Cognitec
704 N. Nob Ave.
Del Mar, CA 92014

Or check your local software store. If you have questions, or would like to order by Visa or Mastercard, call us at (619) 755-1258 (weekdays, 8AM-4PM PST). Dealer inquiries invited.

(Add $2 for shipping. Californians add 6% state tax. Allow 2 weeks for personal checks. Send self-addressed stamped envelope for Telewriter reviews from CCN, RAINBOW, 80-Micro, 80-U.S. Telewriter owners: send SASE or call for information on upgrading to Telewriter-64. Telewriter-compatible spelling checker (Spell 'n Fix) and Smart Terminal program (Colorcom/E) also available. Call or write for more information.)

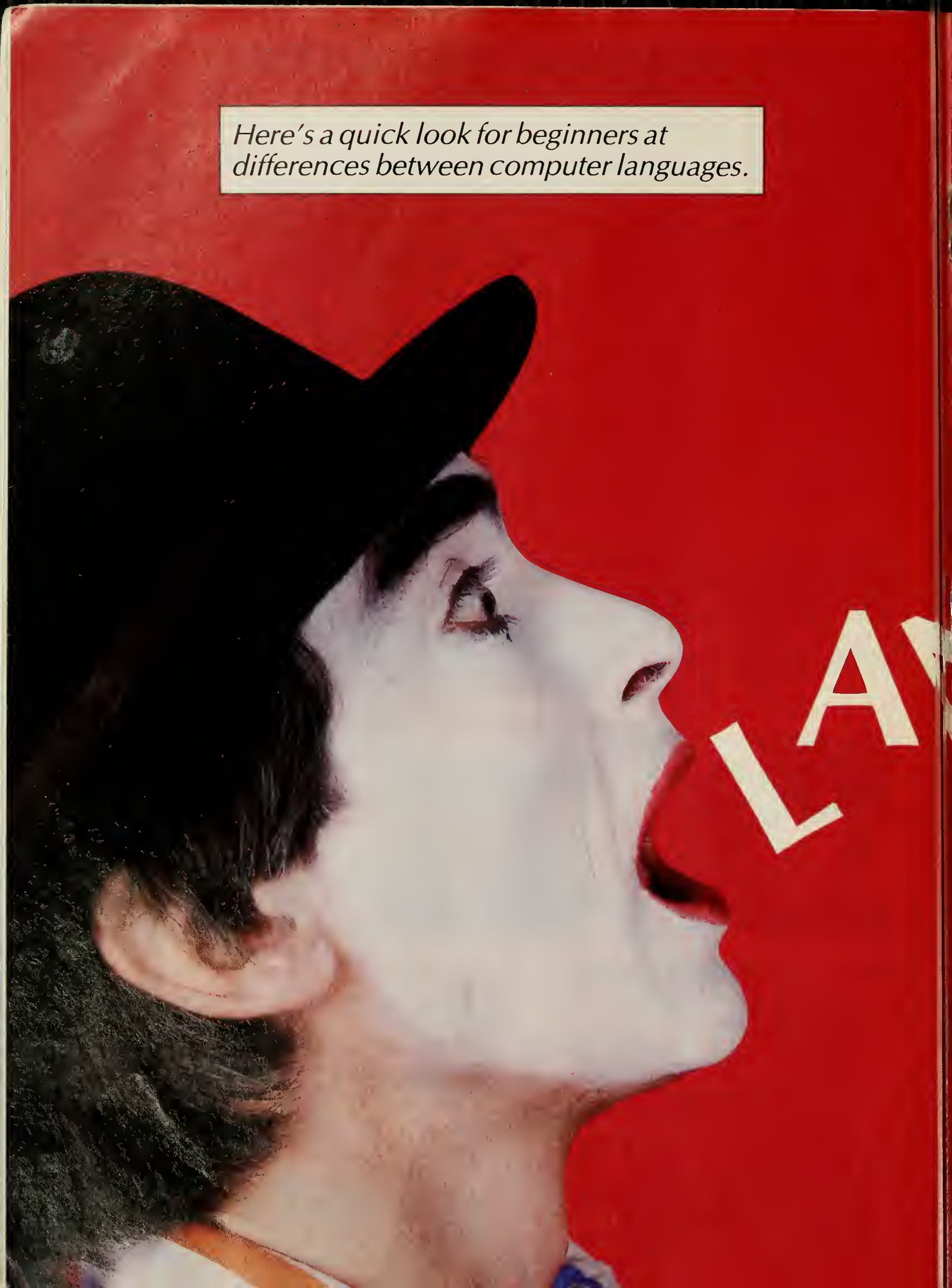
☎ Enter 9 on TeleResponse page 134

```
308 IFD1=28 THEN326
310 IFD3=0THEN312ELSED3=D3+2
312 IFD4=0THEN314ELSED4=D4+2
314 IFD5=0THEN316ELSED5=D5+2
316 IFD6=0THEN318ELSED6=D6+2
318 IFD7=0THEN320ELSED7=D7+2
320 IFD8=0THEN322ELSED8=D8+2
322 IFD9=0THEN324ELSED9=D9+2
324 IFDA=0THEN326ELSEDA=DA+2
326 IFD3=0THEN328ELSELINE(90,25)
-(170,D(D3)),PSET
328 IFD4=0THEN330ELSELINE(90,45)
-(170,D(D4)),PSET
330 IFD5=0THEN332ELSELINE(90,65)
-(170,D(D5)),PSET
332 IFD6=0THEN334ELSELINE(90,85)
-(170,D(D6)),PSET
334 IFD7=0THEN336ELSELINE(90,105
)-(170,D(D7)),PSET
336 IFD8=0THEN338ELSELINE(90,125
)-(170,D(D8)),PSET
338 IFD9=0THEN340ELSELINE(90,145
)-(170,D(D9)),PSET
340 IFDA=0THEN342ELSELINE(90,165
)-(170,D(DA)),PSET
342 GOSUB46:GOTO6
344 GOTO344
346 GOSUB14
348 PRINT"    <*> READING AN EPR
OM <*>    ";A$;
350 GOSUB20:IFQQ=1THENQQ=0:GOTO6
352 CLS:EXEC XR
354 PRINT@256,"EPROM READING IS
COMPLETE.":PRINT"Press "CHR$(34)
"M"CHR$(34)" to return the Menu.
"
356 GOSUB46:IFX$="M"ORX$="m"THEN
6ELSE356
```

Editor's Note: Don't panic—you need one more program listing to use Dennis' Color Burner. The listings are so lengthy we find we have to break this article into a third part. The assembly listing for Color Burner will be printed next month, without text, as Custom Color. Be sure to wait for the final listing before attempting to use the Burner.

☎ Enter 25 on TeleResponse page 134

Here's a quick look for beginners at differences between computer languages.



VGUAGES

by Mike Federle

HOW DOES ONE MAKE SENSE of over 200 computer languages? Experience, lots of experience, but for the hapless beginner, what follows might be the first guide — let's say a simple map scrawled in the dirt with a stick — on how to fathom the syntactical forest.

Our map is a diamond (Figure 1) with strange words written all around it. If we can come to terms with these expressions using the diamond as our guide, then we might begin to tell the trees from the forest.

On the top of the diamond is written *high-level,* on the bottom, *low-level.* On the diamond's left side is the word *interpreted,* on the right, *compiled.* Floating around the diamond are the words *structured* vs *unstructured,* and *general* vs *special* purpose. But which way is up, you wonder?

photo by Charley Freiberg

VIP Writer™

Includes VIP Speller at no additional cost!!

(Formerly Super "Color" Writer II)
By Tim Nelson

RATED TOPS IN RAINBOW, HOT COCO, COLOR COMPUTER MAGAZINE & COLOR COMPUTER WEEKLY

The most powerful and easy-to-use word processor is available in the showpiece and workhorse of the **Library: The VIP Writer™**. Because of its undisputed superiority over all Color Computer word processors, it was selected by Dragon Data Ltd. of England and TANO in the U.S., to be the Official Word Processor for their line of Dragon microcomputers.

The result of two years of research, the **VIP Writer™** offers every feature you could desire from a word processor. It is the most powerful, fastest, most dependable and most versatile. With the hi-res display, workspace and compatibility features built into the **Library** the **Writer** is also the most usable.

". . . Nearly every feature and option possible to implement on the Color Computer. The design of the program is excellent; the programming is flawless . . . Features for the professional, yet it is easy enough for newcomers to master . . . Certainly one of the best word processors available for any computer . . ." October 1983 "Rainbow"

"Word processing with VIP Writer is like driving a high-performance vehicle . . . This Ferarri of a package has more features than Telewriter, Easywriter (for the IBM PC), or Applewriter." October 1983 "Hot CoCo"

The **Writer** will work with you and your printer to do things you always wanted to do. Every feature of your printer can be put to use, every character set, every graphics capability at any baud rate, EVEN PROPORTIONAL SPACING. All this with simplicity and elegance. You can even automatically print multiple copies.

Although all versions feature tape save and load, the disk version provides the Mini Disk Operating System common to the whole **Library**, plus disk file linking for continous printing.

Professional features of particular note:

- Memory-Sense with **BANK SWITCHING** to fully utilize 64K, giving not just 24 or 30K, but up to 61K of workspace with the rompak version and 50K with the disk version.
- TRUE FORMAT WINDOW allowing you to preview the printed page ON THE SCREEN BEFORE PRINTING, showing centered lines, headers, FOOTNOTES, page breaks, page numbers, & margins in line lengths of up to 240 characters. It makes HYPHENATION a snap.
- A TRUE EDITING WINDOW in all 9 display modes for those extra wide reports and graphs (up to 240 columns!).
- FREEDOM to imbed any number of PRINTER CONTROL CODES anywhere, **EVEN WITHIN JUSTIFIED TEXT**.
- Full 4-way cursor control, sophisticated edit commands, the ability to edit any BASIC program or ASCII textfile, SEVEN DELETE FUNCTIONS, LINE INSERT, LOCATE AND CHANGE, wild card locate, up to TEN SIMULTANEOUS block manipulations, word wrap around, programmable tabs, display memory used and left, non-breakable space, and headers, footers and FOOTNOTES.
- Automatic justification, automatic pagination, automatic centering, automatic flush right, underlining, superscripts, subscripts, pause print, single-sheet pause, and print comments.
- Type-ahead, typamatic key repeat and key beep for the pros, ERROR DETECTION and UNDO MISTAKE features, 3 PROGRAMMABLE functions, auto column creation, and an instant on-screen HELP TABLE.

32K (Comes with tape & disk) $59.95

(Includes VIP Speller)

NEW VIP Speller™

WITH A 50,000 WORD INDEXED DICTIONARY!

By Bill Argyros

Gone are the eyestrain, boredom and fatigue from endless proof-reading. **VIP Speller™** is the fastest and most user-friendly speller for your CoCo. It can be used to correct any ASCII file — including **VIP Library™** files and files from **Scripsit™** and **Telewriter™**. It automatically checks files for words to be corrected, marked for special attention or even added to the dictionary. You can even view the word in context, with upper and lowercase. **VIP Speller™** comes with a specially edited 60,000 word dictionary which, unlike other spellers for the CoCo, is indexed for the greatest speed. The shorter your file, the quicker the checking time. And words can be added to or deleted from the dictionary or you can create one of your own. **VIP Speller™** also comes with the **Library's** mini disk operating system for easy disk manipulation.

32K DISK ONLY $39.95

Lowercase displays not available with this program.

VIP™ Library

VIP Calc™

(Formerly Super "Color" Calc)

By Kevin Herrboldt

You can forget the other toy calcs — The real thing is here! No other spreadsheet for the Color Computer gives you:

- **20 ROWS BY 9 COLUMNS ON THE SCREEN AT ONCE**
- **LOWERCASE LETTERS WITH DESCENDERS**
- **UP TO 16 CONCURRENT DISPLAY WINDOWS**
- **FLOATING-POINT MATH**
- **CHOICE OF SINGLE AND DOUBLE PRECISION**
- **WORKS WITH BASE 2, 10, AND 16 NUMBERS**
- **UP TO 512 COLUMNS BY 1024 ROWS**
- **USER DEFINABLE WORKSHEET SIZE FOR MORE MEMORY**
- **LOCATE FUNCTION TO FIND CHECK NUMBERS, NAMES, ETC.**
- **COLUMN/ROW MULTIPLE SORTS**
- **PROGRAMMABLE FUNCTIONS**
- **IMBEDDABLE PRINTER CONTROL CODES**
- **21 ALTERABLE PRINT FORMAT PARAMETERS**
- **ON-LINE HELP TABLES**
- **DOES NOT REQUIRE FLEX OR BASIC**

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By Dan Nelson

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Does your computer speak a foreign language?

Basic is the "natural" language of the microcomputer — every model speaks one dialect of Basic. Basic is also the programming language known by almost every programmer. But it's not the only language your computer can speak, and it's far from the only language it may be taught...

Every language has its uses, its advocates and opponents. To the beginner, comparing languages can seem like comparing apples and oranges. Don't be flustered, however... in this issue we present a special group of articles meant to help you get a feel for various computer languages, what they're good for, and how difficult they may be to use.

Read on!

photo by Charley Freiberg

COLOR BASIC

by Howard Bassen

A Review.

COMPILERS ARE COMPLEX programs that convert the commands and statements of a high-level language like Basic into machine code that a microprocessor can execute at high speed. The Microsoft Color Basic and Extended Basic ROM chips in the Color Computer were written to *interpret* Basic, not *compile* it.

An interpreter is much easier to use, as the source program's text remains in memory and is "translated" and executed one statement at a time, on the fly, before the next statement is dealt with by the interpreter. Errors are spotted as they are encountered, and don't have to affect the operation of the rest of your program. Interpretation of each line in a program is a relatively slow process, which explains why Basic programs used to produce high resolution arcade games, or string or numerical sorts, are slow.

A *compiler* takes the entire high level source code of a program and converts it to a machine code or assembly language file in one operation. If errors are encountered you must rewrite the bad lines and recompile the entire program again. Usually you save the source code on tape or disk before compiling, since a bug in compiled code can *crash*, or lock up, your computer when it runs. You would then have to turn off the computer and reload the compiler and source code. A tape-based system makes this a frustrating chore, so a disk-based compiler is almost a must. Once the compiled code is saved as a machine code file it runs at high speed, like the professional machine code game and utility programs you see advertised.

The Color Compiler appears to offer the best features of the interpreter, with its easy debugging, and the compiler, with its fast execution times. You can protect your secret programming techniques much better by selling or giving away copies of a compiled program, since the program flow of a compiled file (in machine code) is much harder to understand than a Basic source code.

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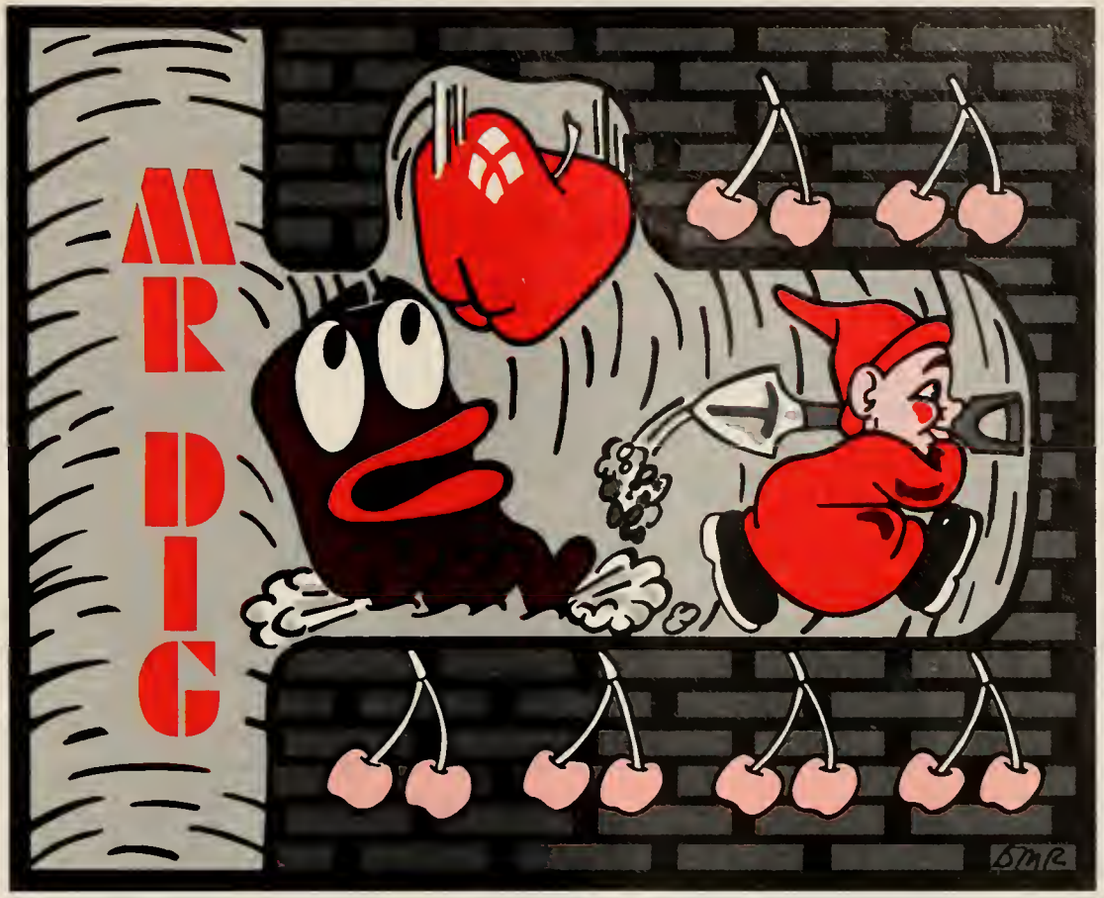
The Color Compiler recognizes a set of about 40 statements and functions from Extended Basic. It uses the debugged Extended Basic source code you have saved on disk. Functions included are advanced high-resolution graphics functions like Circle, Line, Get, and Put (which are very difficult to reproduce in assembly language when you want to generate a fast, machine code graphics program with an editor assembler). Only single letters may be used for variable names, but single-subscripted variables are also allowed, so you can have more than 26 variables in a program. The Color Compiler has no string functions, and can use and print only integers (whole numbers between −32768 and +32767). Therefore, you must usually have an interpreted Basic driver program to accompany the compiled machine code produced by the Color Compiler. It is relatively easy to pass the values of a variable from a Basic driver to the compiled machine code program.

The Computerware documentation is good and includes a table of 21 computations, such as C=PEEK(N), PSET(A,B), C=JOYSTK(0) etc., with a comparison of the execution times for Extended Basic and compiled Basic versions of the same functions. The execution times ran an average of 42 times faster when compiled, for the 21 functions listed. However, some important commands were omitted from this comparison table (such as Put, Line and Circle). I will say more on this important omission later.

To use the Color Compiler, simply write, edit, test and revise your program in normal Extended Basic. The compiled program can get simple (non-subscripted) variable values from a Basic driver program if the variables are not defined in the code to be compiled. For example, you could write the expression (A=2*B) where B is not given a value in the compiled code, but receives a value from the driver program that preceded the code.

To compile debugged source code that has been saved on disk, simply load the compiler, run it, and specify the name of the Basic source program saved on that same disk, plus the starting address where the compiled code is to be placed in memory. Each Basic line is converted to machine code (binary) form, and the code address is then printed on the screen as the compiler processes it. The compiler runs very slowly since it is written in Basic. After every few lines of compilation a disk Read operation takes place. The total process takes about five minutes for a 50 – 100 line Basic program. An error message may pop up at any time and kill the whole operation. If it does, you must go back and debug the problem, (usually a legal Microsoft instruction not allowed by the compiler) and rerun the compiler.

Once program conversion is complete, the Start, End, Execute and Clear addresses appear on the screen. Save the compiled binary code on disk with the SAVEM command. The program can then be run by loading and executing it, or by calling it from a Basic program with the USR function after defining the USR execution address. I developed a method for passing many values (subscripted variables) back to the Basic program by POKEing them into a memory location before the compiled program's operation and getting them back to the Basic program that followed it via PEEK statements. POKEd locations must be protected from destruction by the Basic program by clearing extra memory space below the location specified by the compiler, or the POKEd addresses may be placed above the end of the compiled program code. This makes the program non-relocatable.



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Performance

The Color Compiler comes with six demonstration programs to illustrate its graphics and sound capabilities, plus joystick calls and the various computations and calculations required to generate a game program. A compiled Maze program draws a complex high resolution maze and then traces its way through it at an amazing speed compared to the Basic version. I wanted to see how well the Color Compiler could generate a fast arcade-style high-resolution game, so I wrote the following program:

```
10 DIM A(50)
20 PMODE4,1:SCREEN1,1
30 PCLS0
40 LINE(10,10)-(20,20),PSET,B
50 PAINT (20,20),5,5
60 GET(10,10)-(20,20),A,G
70 PCLS0
80 FOR I=10 TO 220 STEP 5
90 B=JOYSTK(0)*2
100 PCLS0
110 PUT(I,B)-(I+10,B+10),A,PSET
120 NEXT
130 END
```

The program ran a box across the screen in five seconds under Extended Basic. I compiled the program without any difficulty, but when I ran it I was sadly disappointed. The time to travel across the screen was five seconds, no faster than the non-compiled version. The time it took must be due to the fact the PUT function is not sped up by the Color Compiler for the large-size array I chose. Next I tried a moving circle program and left the PCLS0 function out of the loop where it might have slowed down the process.

```
30 TIMER=0
40 PMODE4,1:SCREEN1,1
50 PCLS0
60 FOR I=10 TO 220 STEP 5
70 B=JOYSTK(0)*2
80 CIRCLE(I,B),5,5
90 NEXT
100 PRINT TIMER/60
110 END
```

Again, no speed increase was achieved. I finally tried the PSET function, drawing four two-pixel dots and moving them across the screen with the following program:

```
40 TIMER=0
50 PCLS 0
60 PMODE4,1:SCREEN1,1
70 FOR I=1 TO 200 STEP 5
80 B=JOYSTK(0)
90 J=I
100 GOSUB 170
110 B=B+10:GOSUB170
```

```
120 J=I+10:GOSUB170
130 B=B+10: GOSUB 170
140 NEXT
150 Z=TIMER/60
160 PRINT Z
170 PSET(J,B,5):PSET(J+1,B,5)
180 PSET(J,B,0):PSET(J+1,B,0)
190 RETURN
200 END
```

The compiled version of *this* program ran much faster than the Basic version. I believe the earlier programs were slow because when large-size objects move across the high-resolution screen a conversion from the X,Y coordinates to the screen location address mode of the 6809/VDG chips is required for each pixel in the object. Then the individual pixel is set on the screen. This time-consuming process is efficiently handled by the Put, Line and Circle commands in the Extended Basic ROM that the compiler calls up, so there is little speed-up when compiling these functions for a large number of pixels. I believe techniques used by assembly language programmers for animation would fix this problem. They use a table of data to define a graphic shape and then store (or POKE) the data onto the graphic screen, one byte at a time. This method is very fast, since a byte contains eight pixels, while the Put statement places only one or two pixels onto the graphic screen at a time. The Color Compiler POKEs data fast, so this might be a quick Put method for animation. For details on this technique see Inman's *Assembly Language Graphics*.

I have used the Compiler primarily for long formula calculations done as a subroutine in a large, complex Basic program. The speed-up is quite good for my applications, and the process of debugging and compiling the subroutine was easy and efficient. One drawback I noticed is that the compiled code requires more memory than the Basic program.

I have mixed reactions toward the Color Compiler. It is a good value and easy to use. It produces fast integer computations and simple high resolution graphics, but can not speed up large animated characters like those used in an arcade game using the Put or even the Circle commands. In addition, the compiled code takes up more memory than the Basic source program code that generates it. This compiler will give the intermediate-level Basic programmer a powerful set of tools to produce certain types of fast-running programs, but you won't be able to compete with Zaxxon and Donkey King without learning assembly language programming or using one of the Forth, C, or Pascal compilers.

■ ■ ■

COLOR PILOT

by Norman Garrett

A Review.

THERE IS A GREATER demand for educational software than programmers can presently meet. There are also problems with compatibility among commercial software packages and between those packages and particular syllabi. Commercial software certainly has its place, but often teacher-designed software is more appropriate and better fits specific lesson plans.

The dilemma is that teachers want to write software but lack the expertise to program computer assisted instruction (CAI) packages in languages like Basic. They also often lack the time needed to learn to program and achieve the competency required to create their own programs. It was to meet this need that Color Pilot was developed.

Color Pilot is an "author language," a high level language developed for the specific purpose of designing CAI software. Because of its specific orientation, it's not as versatile as Basic, but it can execute many operations with ease. Instructional units and tests can be designed quickly and without the detail and difficulty that would, for novice programmers, accompany the design of such packages in Basic. That lets educators design and program such software in a relatively short period of time. Pilot is easy to learn and easy to program. It's also quite straightforward, flexible, and, best of all, *forgiving*.

Color Pilot is available for cassette and disk based systems. Cassette Color Pilot is upwardly compatible with disk Color Pilot in that a cassette based program will run on disk Color Pilot; a program written in disk Color Pilot may not, however, run on cassette Color Pilot. The differences between the two are not major, and programs can be transferred once users become familiar with the language and with the differences between the two packages.

One primary need of CAI is good screen design. Color Pilot makes it very easy to format screens. It has a character generator to mix text with graphics and allow both upper- and lowercase. The package even gives you the ability to design your own characters.

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$59.95 cassette, 16K
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Pilot commands are single letter commands, followed by optional operators and a colon. For example, the command that follows will print the phrase "all is well" on the screen:

```
T: all is well
```

That's about as straightforward as commands can get — two keystrokes. Options let the Type statement do other things, too. For example, the following command would clear the screen before printing the text:

```
TS: all is well
```

Many of Basic's graphics features are available in Color Pilot. It is easy to draw shapes and label them using text. Text can be positioned on the screen using "windows" for specific areas of the screen display. This feature is easy to use provided you have a map of the screen; graphics commands require the use of some coordinates to designate screen position.

Color arrangements and text sizes are allowed, though limited. Generally, there are seven display modes with various combinations of colors, reverse or normal video, and large or normal characters. It is easy to switch back and forth between these modes and switching usually requires only one command. A significant drawback in this area is Color Pilot's inability to display more than a 32-character line.

The computational ability of Color Pilot is limited, too, but adequate for those functions typically found in CAI packages. The Compute command is much like the Basic Let command and can be used to assign values to any variable. For example, the following command would increment (increase) the counter:

```
C:X=X+1
```

Additionally, there are some built-in computational fields. One field keeps track of how many questions have been asked. Another keeps track of the percentage of correct answers. Advanced math functions, such as those available in Basic, are not available in Color Pilot.

Pilot's string handling is also similar to Basic. String variable values are assigned using the Compute statement, just like numeric values are assigned. All string variables must be dimensioned (given a fixed length) before they can be used in the program. For example:

```
D:N$(10)
```

will dimension the variable N$ to a fixed length of 10 bytes. (This process can become cumbersome if you are used to the variable length facility of Basic strings.)

Other programming capabilities include conditional and unconditional branching, subroutines, and a fairly sophisticated answer matching mechanism. The Pilot equivalent to Basic's If statement is the Match statement. This statement is one of Color Pilot's most powerful operations, because it allows you some advanced string handling capabilities that can be used to build flexibility into your programs. For instance, if you want to accept an answer that is supposed to be the word "Mississippi," you can tolerate some degree of misspelling by designing your Match statement as follows:

```
M:Mis&ippi
```

To get a match (a TRUE condition), you need only be sure that the first three letters are "Mis" and the last four are "ippi." Any variation can be built into this matching operation. That gives teachers *flexibility* when and where they want it.

Branching is done after the match with the use of the Y or N modifiers on other

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commands. If you wanted to print a statement only if the previous answer was correct, you would use the TYPE statement, modified with a Y.

```
TY: Congratulations, you are correct!
```

This text would print only if the previous Match statement had a true outcome. Using the branch (GOTO equivalent) these parameters effectively gives you your conditional branching capability.

Program Development

Essentially, Pilot works as do many other programming languages as far as program development is concerned. If you are used to Basic, you will find program development in Pilot easy, with the minor difference that the interpreter must be loaded into memory. To create a Pilot program, you must first load a machine language program called Color Pilot (supplied with each version of the system). Load the program as you would any other machine language program and execute it. The screen will clear and then show the prompt PILOT:. You are then ready to enter Pilot commands. You can enter one of three modes available: Edit, Run or Immediate. The Edit mode lets you use the text editor. The Run mode will execute whatever Pilot program is in memory, and the Immediate mode will let you enter direct Pilot commands for immediate execution.

The Color Pilot text editor is an adequate line editor. Programs are easy to enter and modify once you learn six commands. Making your way around the text is easy, fast and accurate, but a big drawback is the inability to move lines. In Basic, line numbers take care of the order. Since Pilot has no line numbers the lines must be entered in the proper order to begin with. A related shortcoming is the lack of a Line Delete command.

Once you have developed your program, you run it by exiting the Edit mode (the Clear key always gets you back to the Pilot prompt), and entering the Run mode. When the program finishes running, you will automatically be placed back in the Pilot command mode. If you have problems, just go back into the Edit mode, change the program, and run it again. Debugging is easy because moving between modes is easy.

In addition to Edit, Immediate and Run, you can list the program to your printer from the Pilot command mode, load a program, or save a program. In the disk version, the disk formatting set-up requires you to use a disk which holds nothing but Pilot programs and files. This is because the saves and loads you ex-

ecute do not use file names but direct disk addresses. No directories are put on the disks, and files are not accessible by Basic unless you know exactly where on the disk they are located. Consequently, you should not use a disk which contains other programs or data files; they may well be overwritten by Color Pilot. The only procedure that works reliably is to format separate Pilot disks.

Up to eight Color Pilot programs may be stored on one disk as fixed length files. Cassette storage has no such limitations, and cassette files are stored in the normal manner. Two unusual, but nice, features of Color Pilot are its ability to link files together (disk version only) and to use an Execute Indirect instruction. File linkage lets you create files that are larger than files you can store in memory (or on disk as a single file) and chain them together. They will load one at a time, and execute in order. By linking three programs together, for example, you could run a program that is actually three separate programs chained together. This is very helpful for large applications and tends to overcome some of the limitations a small computer would typically have.

Execute Indirect executes the contents of a string variable as a Color Pilot instruction. This enhances the interactive capabilities of the language and provides you with more program possibilities, including programs that use random selection of verbal parameters.

Color Pilot has randomization capabilities that use the same syntax as Basic. When combined with Execute Indirect, they can powerfully randomize the execution of portions of a CAI package and guarantee a different presentation order each time the program is run. Sophisticated software packages can be developed with this feature.

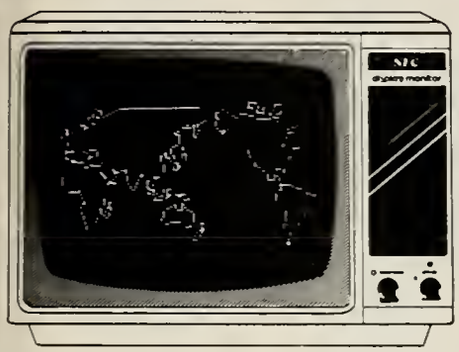
Additional features include the ability to link to assembly language subprograms, control cassette audio output, control video disks and video tape players, and use logical operators like And, Or, and Not.

In general, Color Pilot gives you all you need to design CAI materials. There are a number of things that Color Pilot cannot do, however, without help from Basic or assembly language.

The documentation covers all necessary commands and explanations. By working your way through it sequentially you will learn to use the power of Color Pilot by practicing the examples included. I highly recommend it to any educator with a desire to write software for educational use, but no desire to first learn Basic, which takes longer to master.

■ ■ ■

MONITORS



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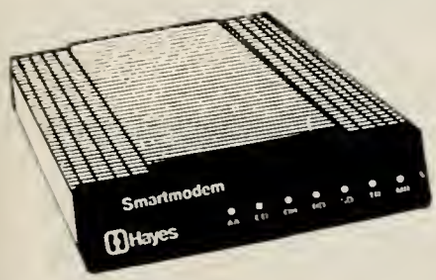

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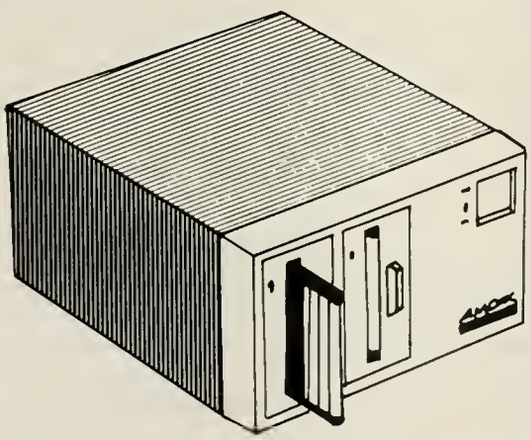

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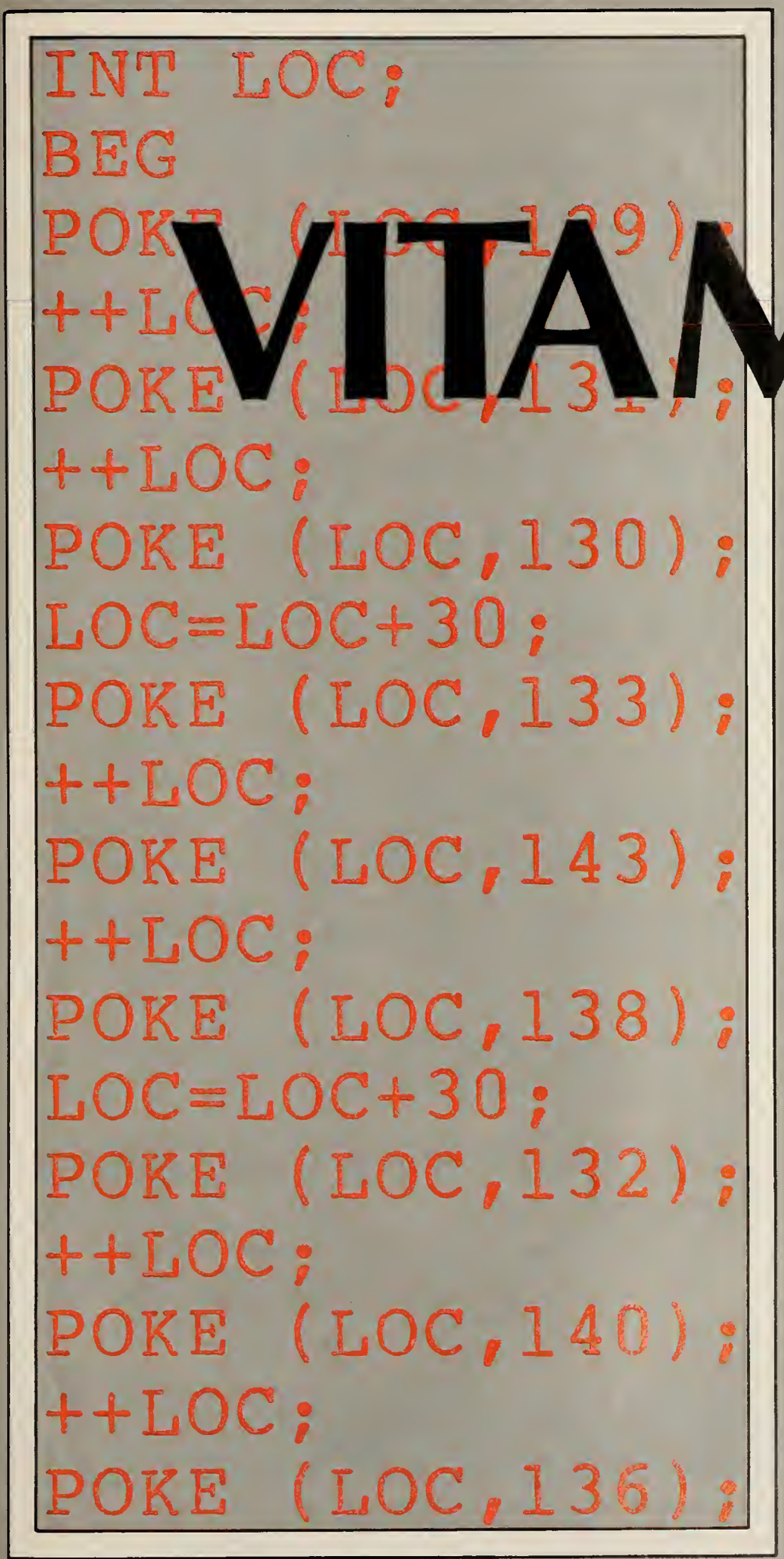


VITAMIN C

Here's a look at C for the Color Computer, and a program you can use.

by Bob Jack

DOES BASIC REMIND you of oatmeal — good, filling, sticks to your ribs, but — *bland*? If so, it's time to put a little vitamin C into your life. Vitamin C means the computer language C. This article explains C and the software needed to run it, and presents a tic-tac-toe program written in C.

Why C?

You're probably wondering what C can do for you. C's end product is an assembly language program. Assembly language programs have three main advantages over interpretive Basic.

First, they run faster; 90 to 100 times faster is not unheard of. In the Tic-Tac-Toe game the computer can calculate its move almost instantaneously. In the Basic version the computer has to calculate for two to three seconds or longer.

Assembly language programs give you greater control over your program operation. While it's true you can probably duplicate any assembly language function with Basic, it's a lot easier to do it on the assembly language level.

Finally, it's pretty hard to tinker with an assembly language program. This means that if you give away or sell a program you've written, you can be sure not too many people are going to fool with it. As long as you control the C source, you control the program!

You may have tried working with an assembler and discovered that assembly language is hard to learn, and hard to use, and that it is hard to incorporate logic on a program level. The one thing assembly programming does well is let you write hardware drivers.

With C you don't have to know assembly language to get assembly language programs! The Tic-Tac-Toe program presented in this article is about eight pages long (three granules on disk) in C. It produces an assembly language program of about 100 pages (15 granules on disk). How long would it take a programmer to write 100 pages of assembly code? The end result was a machine code program about 8K long.

Software

To program in C you need four items: an editor or word processor, a C compiler, an assembler, and a book explaining C commands. The three steps of general work flow are:

- Use an editor and a book on C to produce the source code. Any editor or word processor will work as long as it produces the \ (backslash) code. "Telewriter-64" worked best for me. Save the code on disk in ASCII format using a "TXT" extension.
- Run the C code through the C compiler (at this point all the hard work is done). The C compiler produces an assembler program on disk. If you wish, you can *bit-fiddle* with the program, using your word processor. Bit-fiddle means to optimize your code, make special changes, or whatever. This is not necessary as the program will run perfectly as it comes out of the compiler.

There are a number of good C compilers on the market. My tic-tac-toe game was compiled using the uppercase version of Dugger's C compiler. Evaluate your system and your pocketbook, and call some of the C retailers before you make a choice. You can expect to receive continued support if they give intelligent answers to your questions.

- Run the assembly language program through an assembler. The assembler produces a machine code program on disk. Almost any disk assembler can be used, but try to get an assembler with the "library" command. This will let you *concatenate* (put together) your program modules at assembly time. This will save you a good amount of disk space.

I used Computerware's 6809 Macro Assembler. This assembler is inexpensive, very close to Motorola's full-blown assembler, and does not require another operating system to work.

C Itself

You will discover that program logic is the same no matter what language you are using. To learn a new language all you have to learn is the syntax.

C is a highly structured language. This means you must declare your variables before using them. That's what INT SW, A[20], CT in GCONTROL means. Here I declare SW, A[20], and CT to be integers in the GCONTROL subroutine. This declaration of variables is good only for this one subroutine. It's pretty hard to get mixed up when you have to declare each variable in each subroutine before using them!

Values are passed between subroutines in two ways. The first is through arrays, and the second is by placing them between parentheses. In the statement ARCLR(A);, I'm calling a subroutine to clear an array, and passing the pointer to the A array.

A nice thing about C is that you can spread your statements through one or more lines, and you can include all the comments you like. None of this slows the program down or takes up more memory. Each statement is terminated by a semicolon, which indicates to the compiler the end of each statement.

Statements are arranged in groups by putting an opening bracket and closing bracket around them. Since the Color Computer keyboard is not capable of producing an opening bracket and a closing bracket, Dugger's C compiler uses the at symbol (@) and the dollar sign ($) in place of brackets. Since this confused me, I defined @ as BEG, and $ as END. This makes statement grouping easier to understand.

The If statement in C is pretty much the same as it is in Basic. The difference is that there is no accompanying Then statement. The Then statement is assumed, and any statements or groups of statements following an If statement are acted upon by it.

One function you may not be familiar with is the While statement. The While statement is used in some higher forms of Basic, and it simply means to perform the statement or groups of statements which follow it until a specific test changes. It's kind of like a For/Next loop with an If statement in it.

C statements are normally written in lowercase. You will probably find that is quite inconvenient. Dugger's C includes an uppercase version, saving you from having to continually hit the shift key. You may also find uppercase easier to read.

Tic-Tac-Toe

The Tic-Tac-Toe program can be split into two parts — logic and display. The following is a short explanation of the subroutines.

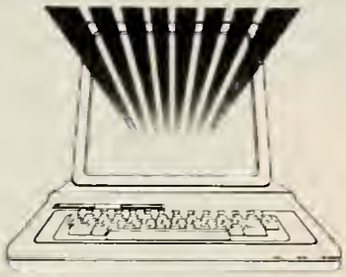
Logic — All C programs begin with MAIN, the main subroutine. In this program, MAIN first calls SCRN1 which calls up the opening screen display. After returning, MAIN then calls GCONTROL, which actually plays the game.

GCONTROL gets the player's move from PLYMOV and then calls PLAY. PLAY alternates between fetching the computer's move from COMOV and the player's move from PLYMOV. It also tests for wins and losses with MTEST. When a win, loss, or tie is encountered it returns to GCONTROL. GCONTROL then restarts the game sequence, changing the opening move to the computer.

The computer move subroutine, COMOV, looks at three different types of moves the computer could make. Does the computer have a winning move? If so, it goes to CWMT. Can the computer block your next winning move? If so, it goes to CBMT. The final option is to make a random move: RNDMOV.

C has no random function, so I scrambled all the possible moves and then let RNDMOV key on the player's last move. The player's last move is passed to the subroutine through A[11].

SUPER SCREEN



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You can now write truly professional looking programs that combine text with hi-res graphics. Super Screen allows you to create graphics displays with the Basic LINE, DRAW and CIRCLE statements and then notate the graphics with descriptive text. You can even use PRINT @ if you wish for greater programming convenience. Super Screen's versatility will amaze you.

PRINT @ IS FULLY IMPLEMENTED

The PRINT @ statement is a valuable asset to the programmer when formatting text on the screen. The standard Color Computer will report an error if you specify a location higher than 511 but Super Screen allows locations all the way to 1223! You get a big screen and a powerful formatting tool as well. Of course, Super Screen also supports the CLS command allowing you to clear the big screen using standard Basic syntax.

ON ERROR GOTO

That's right! Super Screen gives you a full implementation of ON ERROR GOTO including the ERR and ERL functions. Now you can trap errors and take corrective action to prevent crashed programs and lost data using the same standard syntax as other computers. The ON ERROR GOTO capability overcomes a serious deficiency of Color Computer Basic and greatly improves your capability to handle sophisticated tasks. All well written, 'user friendly' programs use error trapping techniques and yours can too! Now that's power!

AUTO KEY REPEAT

No more frustration as you edit a long line in your Basic program, just hold the space bar down and automatically step to the desired position in the line. Need a line of asterisks? Hold the key down and auto repeat will give them to you. Those of you who spend many hours at your keyboard will appreciate this outstanding addition to Super Screen's long list of impressive capabilities.

CONTROL CODES FOR ADDITIONAL FUNCTIONS

Super Screen recognizes several special control code characters that allow selection of block or underline, solid or blinking cursor and other functions. You can 'Home Up' the cursor or you may erase from the cursor to the end of a line or to the end of the screen just like many other computers. These special codes give you an extra dimension of versatility and convenience that put Super Screen in a class by itself.

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Up to 255 separate accounts may be defined and a single disc system can hold over 1,400 transactions. This system automatically enhances the monitor screen to a 51 character by 24 line display. 32K of memory is required along with an 80-column printer and one or more disc drives.

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The Mark Data Products sales order processing system provides a fast, efficient means to enter orders, print shipping papers and invoices, prepare sales reports, and monitor receivables. The system automatically enhances the monitor screen to a 51 character by 24 line display. 32K of memory is required along with an 80-column printer, and one or more disc drives.

The MDP order entry system is a family or programs which operate interactively by means of a "menu" selection scheme. Up to 900 products may be defined and a single disc system can hold over 600 transactions. When the operator selects a task to be performed, the computer loads a program designed to handle that task from the system disc. The system disc contains all of the programs required to create, update and maintain data files and prepare the necessary paperwork including shipping and invoice forms, daily sales reports, a monthly (or other period) sales report and a receivables report.

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The subroutine MTEST, used to test for a win, is the most complicated subroutine in the program. This short subroutine produced about 25 pages of the assembly language program, about a quarter of the total program. That's why I like Vitamin C is assembly language: otherwise I'd probably still be programming the second or third page!

Display — While logic makes a program run, you will find the display is at least as important. You can have the world's best written program, but with a poor display the program would be worthless.

There are three different displays in Tic-Tac-Toe, all using the alpha screen because alpha and graphics had to be mixed. A coarse graphic display is not a hindrance to Tic-Tac-Toe.

The first subroutine, SCRN1, clears the screen (CLEARS), plays three notes of sound (SNDTTT), and puts up the cross-hatches of the Tic-Tac-Toe board (STRBLNS).

SNDTTT simply calls the BEEP subroutine three times. The BEEP subroutine is an assembly language routine to produce noise. It does not come as a standard library function in Dugger's C, so its listing is included. Its function is similar to the SOUND function in Basic.

The heart of the display is STRBLNS. This subroutine puts colored lines on the screen, using VERTLN and LATLN. It calls DELAY for timing the lines. In the SCRN1 call the delay is 500, which is rather slow. This is done so that the color of the lines is plainly shown. VERTLN and LATLN draw the lines by simply POKEing onto the screen.

The second display is a set of subroutines which show the game in progress. After the initial cross-hatch and numeric information are put on the screen (SCRN2), the game can then place an X or an O in any of its nine game positions (PUTMOV) (PUTMVX).

These two subroutines operate in the same way. They "flutter" the X's and O's on the screen. The flutter is limited to seven ons and offs, timed by calling an ascending tone between them. The flutter is achieved by calling PUTO, PUTX, or PUTCLR. These routines simply POKE an O, X, or clear spot on the screen.

The last display comes out of the WTEST subroutine. This subroutine checks for wins, losses or ties. It calls PRT1, 2 or 3. These routines put the alpha on the screen and then call the ANYKEY subroutine.

The ANYKEY subroutine uses STRBNLNS and a fast delay (100) to put a shimmering border around the screen. It also waits for you to touch a key.

■ ■ ■

Program Listing. Tic-Tac-Toe in C

```
/* GET PLAYER MOVE */

PLYMOV (A)
     INT A[];
     BEG
     INT MOV;
     BEEP (1,1);
     WHILE (1) BEG
          MOV=NWCHAR (0);
          IF (MOV==3)
               EXIT ();
          IF (MOV>48 & MOV<58) BEG
               MOV=MOV-48;
               IF (A[MOV]==45)
                    RETURN (MOV);
               END
          END
     END

/* COMP MOVE */

COMOV (A)
     INT A[];
     BEG
     INT SW;
     SW=CWMT (A);
     IF (SW>0)
          RETURN (SW);
     SW=CBMT (A);
     IF (SW>0)
          RETURN (SW);
     SW=RNDMOV (A);
     RETURN (SW);
     END

/* COMP WIN MOVE TEST */

CWMT (A)
     INT A[];
     BEG
     INT X, SW;
     X=1;
     WHILE (X<10) BEG
          IF (A[X]==45) BEG
               A[X]=79;
               SW=MTEST (A);
               A[X]=45;
               IF (SW==1)
                    RETURN (X);
               END
          ++X;
          END
    X=0;
    RETURN (X);
    END

/* COMP BLOCK MOVE TEST */

CBMT (A)
     INT A[];
     BEG
     INT X, SW;
     X=1;
     WHILE (X<10) BEG
          IF (A[X]==45) BEG
               A[X]=88;
               SW=MTEST (A);
               A[X]=45;
               IF (SW==1)
                    RETURN (X);

/* DEFINE MACROS */

#DEFINE     BEG     @
#DEFINE     END     $
```

```
MAIN ()
     BEG
          SCRN1 ();
          GCONTROL ();
     END


/* - - - LOGIC - - - */

/* GAME CONTROL */

GCONTROL () BEG
     INT SW, A[20], CT;
     WHILE (1) BEG
          ARCLR (A);
          CT=0;
          SCRN2();
          SW=PLYMOV (A);
          A[11]=SW;
          A[SW]=88;
          PUTMVX (SW);
          SW=PLAY(A,CT);
          WTEST(A,SW);
          ARCLR(A);
          CT=0;
          SCRN2 ();
          SW=COMOV(A);
          A[SW]=79;
          PUTMVO (SW);
          SW=PLYMOV(A);
          A[SW]=88;
          A[15]=SW;
          PUTMVX (SW);
          ++CT;
          SW=PLAY(A,CT);
          WTEST(A,SW);
          END
     END

/* PLAY GAME */

PLAY (A,CT)
     INT A[], CT;
     BEG
     INT SW, WT;
     WHILE (1) BEG
          WT=MTEST (A);
          IF (WT==1)
               RETURN(2);
          ++CT;
          IF (CT==9)
               RETURN(3);
          SW=COMOV (A);
          A[SW]=79;
          PUTMVO (SW);
          WT=MTEST (A);
          IF (WT==1)
               RETURN(1);
          ++CT;
          IF (CT==9)
               RETURN(3);
          SW=PLYMOV (A);
          A[11]=SW;
          A[SW]=88;
          PUTMVX (SW);
          END
     END
               END
          ++X;
          END
     X=0;
     RETURN (X);
     END
```

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```
/* STROBE LINES */

STRBLNS (L1,L2,L3,L4,DL)
     INT L1, L2, L3, L4, DL;
     BEG
     INT CHR, C, L, X, Y;
     X=159;
     Y=0;
     WHILE (1)
          BEG
          C=X+Y;
          VERTLN(L1,C);
          DELAY(DL);
          VERTLN(L2,C);
          DELAY(DL);
          LATLN(L3,C);
          DELAY(DL);
          LATLN(L4,C);
          DELAY(DL);
          Y=Y+16;
          IF (Y>96)
               Y=0;
          CHR=NWCHAR(0);
          IF (CHR>0)
               RETURN (CHR);
          END
     END

/* PUT VERTICAL LINES */

VERTLN(L,C)
     INT L, C;
     BEG
     INT X,Z;
     X=0;
     WHILE (X<481)
          BEG
          Z=L+X;
          POKE (Z,C);
          X=X+32;
          END
     END

/* PUT LATERAL LINES */

LATLN (L,C)
     INT L,C;
     BEG
     INT X,Z;
     X=0;
     WHILE (X<32)
          BEG
          Z=L+X;
          POKE (Z,C);
          ++X;
          END
     END

/* FIRST HEADER */

HDR1()
     BEG
     PRINTF("\N\N");
     PRINTF("   TIC\N");
     PRINTF("\N\N\N\N\N");
     PRINTF("              TAC\N");
     PRINTF("\N\N\N\N\N");
     PRINTF("                ");
     PRINTF("          TOE\N");
     PRINTF("BJ83");
     END

/* DELAY LOOP */

DELAY(DL)
     INT DL;
     BEG
     INT X;
```

```
     X=0;
     WHILE (X<DL)
          BEG
          ++X;
          END
     END

/* SECOND SCREEN */

SCRN2 ()
     BEG
     INT C, X;
     C=128;
     CLEARS();
     PRINTF ("\N\N    7          8");
     PRINTF ("          9\N\N\N\N\N\N");
     PRINTF ("    4          5          6");
     PRINTF ("\N\N\N\N\N\N    1          2");
     PRINTF ("          3");
     VERTLN (1033,C);
     VERTLN (1045,C);
     LATLN (1184,C);
     LATLN (1376,C);
     END

/* CONTROL "O"'S */

PUTMVO (MOV)
     INT MOV;
     BEG
     INT X, Y, LOC;
     X=1;
     LOC=GETLOC (MOV);
     WHILE (X<8)
          BEG
          Y=((X*14)+150);
          PUTO (LOC);
          BEEP (Y,1);
          PUTCLR (LOC);
          BEEP (Y,1);
          ++X;
          END
     PUTO (LOC);
     END

/* CONTROL "X"'S */

PUTMVX (MOV)
     INT MOV;
     BEG
     INT X, Y, LOC;
     X=1;
     LOC=GETLOC (MOV);
     WHILE (X<8)
          BEG
          Y=((X*14)+150);
          PUTX (LOC);
          BEEP (Y,1);
          PUTCLR (LOC);
          BEEP (Y,1);
          ++X;
          END
     PUTX (LOC);
     END

/* GET SCREEN LOCATION FOR MOVE */

GETLOC (MOV)
     INT MOV;
     BEG
     IF (MOV==1)
          RETURN (1443);
     IF (MOV==2)
          RETURN (1454);
     IF (MOV==3)
          RETURN (1465);
     IF (MOV==4)
          RETURN (1251);
```

```
/* MATCH TEST */

MTEST (A)
      INT A[];
      BEG
      INT SW;
      SW=1;
      IF (A[2]!=45) BEG
            IF (A[1]==A[2] & A[2]==A[3])
                  RETURN (SW);
            END
      IF (A[4]!=45) BEG
            IF (A[1]==A[4] & A[4]==A[7])
                  RETURN (SW);
            END
      IF (A[6]!=45) BEG
            IF (A[3]==A[6] & A[6]==A[9])
                  RETURN (SW);
            END
      IF (A[8]!=45) BEG
            IF (A[7]==A[8] & A[8]==A[9])
                  RETURN (SW);
            END
      IF (A[5]!=45) BEG
            IF (A[1]==A[5] & A[5]==A[9])
                  RETURN (SW);
            IF (A[2]==A[5] & A[5]==A[8])
                  RETURN (SW);
            IF (A[4]==A[5] & A[5]==A[6])
                  RETURN (SW);
            IF (A[3]==A[5] & A[5]==A[7])
                  RETURN (SW);
            END
      SW=0;
      RETURN (SW);
      END

/* RANDOM MOVE */

RNDMOV (A)
      INT A[];
      BEG
      INT X, B[10];
      B[1]=7;
      B[2]=3;
      B[3]=9;
      B[4]=1;
      B[5]=8;
      B[6]=2;
      B[7]=6;
      B[8]=4;
      B[9]=5;
      X=A[11];
      WHILE (1) BEG
            IF (A[X]==45)
                  RETURN (X);
            X=B[X];
            END
      END

/* ARAY CLEAR */

ARCLR (A)
      INT A[];
      BEG
      INT SW;
      SW=1;
      WHILE (SW<11) BEG
            A[SW]=45;
            ++SW;
            END
      END

/* WIN TEST */

WTEST (A,SW)
      INT A[],SW;
```

```
      BEG
      IF (SW==1) BEG
           PRT1();
           RETURN;
           END
      IF (SW==2) BEG
           PRT2();
           RETURN;
           END
      IF (SW==3) BEG
           PRT3();
           RETURN;
           END
      END

/* - - - DISPLAY - - - */

/* END GAME PRINT DRIVERS */

PRT1() BEG
      PRT4 ();
      PRINTF ("              I WIN\N");
      ANYKEY();
      END

PRT2() BEG
      PRT4 ();
      PRINTF ("             YOU WIN\N");
      ANYKEY();
      END

PRT3() BEG
      PRT4 ();
      PRINTF ("               TIE\N");
      ANYKEY();
      END

PRT4() BEG
      CLEARS ();
      PRINTF ("\N\N\N\N\N\N\N\N");
      END

/* ANY KEY TO CONTINUE */

ANYKEY () BEG
      INT C, L1, L2, L3, L4, DL;
      PRINTF ("\N       ");
      PRINTF ("ANY KEY TO CONTINUE ");
      BEEP (1,1);
      L1=1024;
      L2=1055;
      L3=1024;
      L4=1504;
      DL=100;
      C=STRBLNS (L1,L2,L3,L4,DL);
      IF (C==3)
           EXIT ();
      END

/* FIRST SCREEN */

SCRN1()
      BEG
      INT C, L1, L2, L3, L4, DL;
      CLEARS ();
      SNDTTT ();
      HDR1();
      L1=1033;
      L2=1045;
      L3=1184;
      L4=1376;
      DL=500;
      C=STRBLNS (L1,L2,L3,L4,DL);
      IF (C==3)
           EXIT();
      END
```

```
      IF (MOV==5)
           RETURN (1262);
      IF (MOV==6)
           RETURN (1273);
      IF (MOV==7)
           RETURN (1059);
      IF (MOV==8)
           RETURN (1070);
      IF (MOV==9)
           RETURN (1081);
      END

/* PUT "O"'S */

PUTO (LOC)
      INT LOC;
      BEG
      POKE (LOC,129);
      ++LOC;
      POKE (LOC,131);
      ++LOC;
      POKE (LOC,130);
      LOC=LOC+30;
      POKE (LOC,133);
      ++LOC;
      POKE (LOC,143);
      ++LOC;
      POKE (LOC,138);
      LOC=LOC+30;
      POKE (LOC,132);
      ++LOC;
      POKE (LOC,140);
      ++LOC;
      POKE (LOC,136);
      END.

/* PUT "X"'S */

PUTX (LOC)
      INT LOC;
      BEG
      POKE (LOC,134);
      ++LOC;
      POKE (LOC,143);
      ++LOC;
      POKE (LOC,137);
      LOC=LOC+30;
      POKE (LOC,143);
      ++LOC;
      POKE (LOC,128);
      ++LOC;
      POKE (LOC,143);
      LOC=LOC+30;
      POKE (LOC,137);
      ++LOC;
      POKE (LOC,143);
      ++LOC;
      POKE (LOC,134);
      END

/* PUT CLEAR "O" OR "X" */

PUTCLR (LOC)
      INT LOC;
      BEG
      INT C;
      C=143;
      POKE (LOC,C);
      ++LOC;
      POKE (LOC,C);
      ++LOC;
      POKE (LOC,C);
      LOC=LOC+30;
      POKE (LOC,C);
      ++LOC;
      POKE (LOC,C);
      ++LOC;
      POKE (LOC,C);
      LOC=LOC+30;
      POKE (LOC,C);
      ++LOC;
      POKE (LOC,C);
      ++LOC;
      POKE (LOC,C);
      END

/* FIRST SOUND */

SNDTTT ()
      BEG
      BEEP (28,1);
      BEEP (14,2);
      BEEP (1,1);
      END
```

Look and C

by Bob Jack

RELAX, HERE'S HELP! The following is an in-depth explanation of some of the common subroutines used in Tic-Tac-Toe. A vast number of programs can be written by combining and recombining the elements shown in these subroutines. Also, once you learn C you're going to look like a pro!

If you've looked over the Tic-Tac-Toe program you may have guessed C works through loops. You write subroutines to accomplish the most basic tasks possible. The simpler the subroutines are, the better they are.

Included below are input, output, and delay loops. These very basic subroutines should give you an idea how C works.

Input

A most common subroutine is where the computer stops and waits for information to be entered. At the heart of any input subroutine is the function which reads the input device (keyboard, etc.). C has a number of standard input functions; some are SCANF(—), GETCHAR( ), and NWCHAR(-).

In the PLYMOV subroutine (get players move), NWCHAR was used because it takes a quick look at the keyboard. This is very close to the way Basic's INKEY$ operates. The following is the subroutine in C and a step by step explanation.

PLYMOV(A) — defines the location of the subroutine and receives variable A.
INT A[ ]; — declares variable A to be an integer array.
BEG — begins the subroutine.
INT MOV; — declares MOV variable to be an integer used only in this subroutine.
BEEP(1,1); — GOSUB to BEEP, passing tone of 1 and duration of 1.
WHILE(1) — loop forever: no test is being performed inside the parentheses.
BEG — begin the While loop.
MOV=NWCHAR(0); — strobes keyboard and places character in MOV variable.
IF (MOV==3) EXIT( ); — if variable contains a Break key, go back to Basic.
IF (MOV>48 & MOV<58) — tests if variable is between 1 and 9.
BEG — begin IF routine.
MOV=MOV−48; — convert variable to a number.
IF(A[MOV]==45) — tests if move has been used.
RETURN(MOV); — if move has not been used, returns from subroutine with new move.
END — end of IF routine, coupled to previous BEG.
END — end of WHILE loop.
END — end of PLYMOV.

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Now, the same subroutine in Basic:

```
100 ' PLYMOV
110 '
120 SOUND 1,1            ' MAKE NOISE
130 MOV$=INKEY$          ' GET MOVE
140 IF (MOV$>"0"         ' CHECK FOR NUMBER
AND MOV$<("9"+1))          BETWEEN 1-9
THEN 170
150 GOTO 130             ' IF NOT LOOP BACK
160 MOV=VAL(MOV$)        ' CONVERT TO NUMBER
170 IF A(MOV)=45         ' RETURN IF MOVE HAS
THEN RETURN                NOT BEEN USED
180 GOTO 130             ' IF USED LOOP BACK
```

It may appear Basic is easier to understand than C, but as you become more at ease with C you will find the concepts used in it are simpler, and therefore easier to understand.

An example: if you change the 0 in the C command MOV=NWCHAR(0); to 1: MOV=NWCHAR(1);, the key pressed will automatically be echoed to the screen. This takes at least two additional lines in Basic to do correctly.

Another example: by leaving out the next C command (IF (MOV==3) EXIT( );) you have effectively disabled the Break key.

This ability to give you assembly language-like control is one of the things which makes C worth learning.

Output

This program uses two methods to get information out of the computer and onto the screen. They are PRINTF(—), which stands for format printing, and POKE(X,Y), for graphics.

The vertical and lateral lines and the X's and 0's all fall in the graphics area. These are put on the screen through the use of the POKE function. This function is almost identical to that function in Basic.

The LATLN subroutine (put lateral lines) is a good example of how POKE is used to put simple graphics on the screen. The following is the subroutine in C:

LATLN(L,C) — defines location of subroutine and receives variables L and C.
INT L,C; — declares variables L and C to be external integers.
BEG — begins the subroutine.
INT X,Z; — declares variables X and Z to be integers used only in this subroutine.
X=0; — makes X equal to 0.
WHILE(X<32) — loop as long as X is smaller than 32.
BEG — begin loop.
X=L+X; — make Z equal to L + X. L is the decimal beginning location of the line.
POKE(Z,C); — POKE color or graphic character C at location Z.
++X; — increment X by 1, and do loop test.
END — end of WHILE loop.
END — end of LATLN.

Now, the same subroutine in Basic.

```
100 ' LATLN
110 '
120 X=0                  ' CLEAR X
130 Z=L+X                ' FORM POKE LOCATION
140 POKE Z,C             ' PUT COLOR ON SCREEN
150 X=X+1                ' INCREMENT X
160 IF X<32 THEN 130     ' LOOP BACK IF NOT
                           FINISHED
170 RETURN               ' RETURN
```

If you remove all the structuring from the C routine and compare it to the Basic routine you will find they are almost identical. The major difference is that in the C routine ++X; is roughly equal to Lines 150 and 160 in the Basic routine. Using this type of routine and variations

on it, you should be able to handle almost any type of graphics program.

The second type of screen output is accomplished via the PRINTF function. Since this program is more or less a graphics program, the PRINTF function was not used to its full capacity. The HDR1 subroutine (first header) uses this function and will serve as our C example.

HDR1( ) — defines location of subroutine.
BEG — begins subroutine.
PRINTF("\N\N"); — does two CR/LF.
PRINTF(" TIC\N"); — prints three spaces, then TIC, then one CR/LF.
PRINTF("\N\N\N\N\N"); — does five CR/LF.
PRINTF(" TAC\N"); — prints 14 spaces, then TAC, then one CR/LF.
PRINTF("\N\N\N\N\ N"); — does five CR/LF.
PRINTF(" "); — prints 15 spaces.
PRINTF(" TOE\N"); — prints 10 spaces, then TOE, then one CR/LF.
PRINTF("BJ83"); — prints my initials and the year.
END — end of HDR1.

Now, the same routine in Basic.

```
100 ' HRD1
110 '
120 PRINT@32x2+3,"TIC"      ' STANDARD PRINT
                              STATEMENTS
130 PRINT@32x7+14,"TAC"     ' SAME
140 PRINT@32x14+25,"TOE"    ' SAME
150 PRINT@32x15,"BJ83"      ' SAME
160 RETURN                  ' RETURN
```

Basic wins no contest in this subroutine. Writing a formatted print subroutine in C is similar to doing it in Basic, but without the benefit of the PRINT@ command. One consolation is that since the end product of C is assembly language, its subroutine executes faster.

Delay Loop

C runs so fast that delay loops are an indispensable part of most programs. This is especially true when you get into graphics programming. The DELAY function (delay loop) is a good example of a controllable delay loop. It is also a good example of how to use the WHILE function. The following is the subroutine in C and a step by step explanation.

DELAY(DL) — defines location of subroutine and receives variable DL.
INT DL; — declares variable DL to be external integer.
BEG — begins the subroutine.
INT X; — declares variable X to be an integer used only in this subroutine.
X+0; — makes X equal to 0.
WHILE(X<DL) — loops as long as X is smaller than DL.
BEG — begins loop.
++X; — increments X by one and does loop test.
END — ends WHILE loop.
END — end of DELAY.

Now, the same subroutine in Basic.

```
100 ' DELAY
110 '
120 FOR X=1 TO DL       ' STANDARD FOR/NEXT
                          LOOP
130 NEXT X              ' SAME
140 RETURN              ' RETURN
```

The BEEP function (sound routine) can be thought of and used as a delay loop. This can open up many sound and graphics combinations. The subroutines PUTMVX and PUTMVO combine sound and graphics to flutter the X's or 0's when first putting them on the screen.

Since C's final product is an assembly language program, here's an idea. You might want to try combining C's routines with your Basic programs. You do this by using Basic's USR routine. ■ ■ ■

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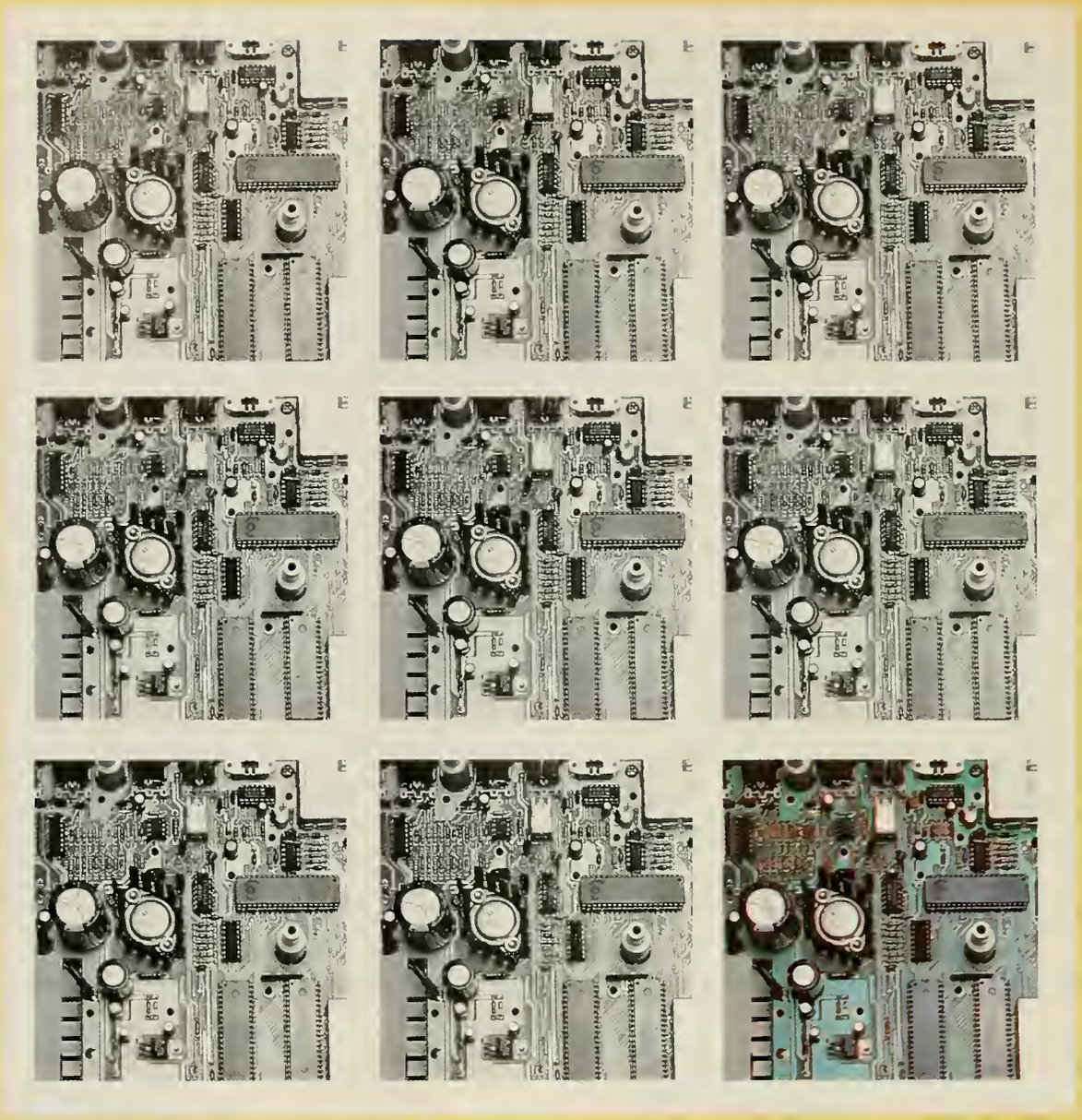

Dissecting Your ROM

Part nine in a series of 14.

by Jake Commander

THE SECOND SLICE of Extended Color Basic finishes off the new transcendental functions with EXP and FIX. From here on, there are several sundry routines which really distinguish between standard and Extended Basic.

First is the machine code for the command you'll never know how you did without — the Edit command. This is a small subsystem unto itself, with various subcommands initiated by predefined keyboard characters. Because the keystroke detection is so clear in the code, the logical flow is a cinch to follow. Delving into this part is a good exercise for newcomers to the dissassembly of raw machine code.

Extended string processing follows the Edit command with functions like MID$ at the left-hand side of the equals sign, INSTR and STRING$. Following this is the code for &O and &H — octal and hexadecimal number conversions. Note that the code for octal conversion contains a bug, as it allows for an octal digit of 8. To the hexadecimal-minded this is tantamount to allowing the letter "G" in hex!

Also coded in this portion are FN and DEFFN, along with USR and DEFUSR, giving a distinct impression that the power of Basic is unfolding at a really fast rate. Lastly, we have the routines to deal with the Timer and Line Input commands. Both these are easy to follow, as are most routines in this section. The string functions can be a little convoluted, but almost everything else is simple.

In a little over 2K, a great deal of what is missing from Color Basic has been spliced in. Despite covering such a large repertoire of Extended commands, most of the extra code is still to come! ■ ■ ■

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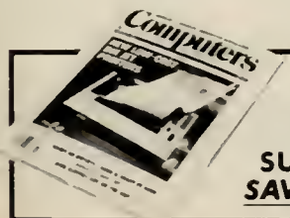

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Program Listing. ROM Dissection

```
Line                Object
Number  Address     Code        Mnemonic  Operand     Jake's Comment

EXP constants
00603   84C4 81 38              CMPA    #$38
00604   84C6 AA 3B              ORA     -5,Y
00605   84C8 29 07              BVS     $84D1
00606   84CA 71
00607   84CB 34 58              PSHS    DPR,X,U
00608   84CD 3E
00609   84CE 56                 RORB
00610   84CF 74 167E            LSR     $167E
00611   84D2 B3 1B77            SUBD    $1B77
00612   84D5 2F EE              BLE     $84C5
00613   84D7 E3 85              ADDD    B,X
00614   84D9 7A 1D84            DEC     $1D84
00615   84DC 1C 2A              ANDCC   #$2A
00616   84DE 7C 6359            INC     $6359
00617   84E1 58                 ASLB
00618   84E2 0A 7E              DEC     <$7E
00619   84E4 75
00620   84E5 FD E7C6            STD     $E7C6
00621   84E8 80 31              SUBA    #$31
00622   84EA 72
00623   84EB 18
00624   84EC 1081
00625   84EE 00 00              NEG     <0
00626   84F0 00 00              NEG     <0

EXP(n)
00627   84F2 8E 84C4            LDX     #$84C4      ;=> 0.442695041
00628   84F5 BD BACA            JSR     $BACA       ;Multiply by n
00629   84F8 BD BC2F            JSR     $BC2F       ;Copy result to sratch1 @ $0040
00630   84FB 96 4F              LDA     <$4F        ;Exponent of result
00631   84FD 81 88              CMPA    #$88        ;Result > 2^8 ?
00632   84FF 25 03              BLO     $8504       ;If not
00633   8501 7E BB5C            JMP     $BB5C       ;Else check possible overflow
00634   8504 BD BCEE            JSR     $BCEE       ;Get integer of FPAC1
00635   8507 96 01              LDA     <1          ;Integer byte
00636   8509 8B 81              ADDA    #$81        ;Form exp+bias+1
00637   850B 27 F4              BEQ     $8501       ;Possible overflow
00638   850D 4A                 DECA                ;Adjust F.P. exponent
00639   850E 34 02              PSHS    A           ;Save exponent
00640   8510 8E 0040            LDX     #$0040      ;=> n*0.442695041
00641   8513 BD B9B9            JSR     $B9B9       ;Result minus INT(result)
00642   8516 8E 84C9            LDX     #$84C9      ;=> exponent coefficient table
00643   8519 BD BEFF            JSR     $BEFF       ;Do summation
00644   851C 0F 62              CLR     <$62        ;Sign of result
00645   851E 35 02              PULS    A           ;Restore F.P. exponent
00646   8520 BD BB48            JSR     $BB48       ;Add to FPAC1 exponent
00647   8523 39                 RTS

FIX(n)
00648   8524 BD BC6D            JSR     $BC6D       ;Get sign of FPAC1 to B
00649   8527 2B 03              BMI     $852C       ;If negative
00650   8529 7E BCEE            JMP     $BCEE       ;Else get INT(n)
00651   852C 03 54              COM     <$54        ;Make FPAC1 positive
00652   852E 8D F9              BSR     $8529       ;Get INT(n)
00653   8530 7E BEE9            JMP     $BEE9       ;Negate FPAC1 again
```

```
Line                Object
Number  Address     Code        Mnemonic  Operand     Jake's Comment

EDIT
00654   8533 BD 89AE            JSR     $89AE       ;Get line number to <$2B
00655   8536 32 62              LEAS    2,S         ;Pull return address
00656   8538 86 01              LDA     #1          ;Set flag to
00657   853A 97 D8              STA     <$D8        ;print buffer
00658   853C BD AD01            JSR     $AD01       ;Search for line number in <$2B
00659   853F 1025 298F          LBLO    $AED2       ;If ?UL Error
00660   8543 BD B7C2            JSR     $B7C2       ;Decode basic to buffer
00661   8546 1F 20              TFR     Y,D         ;Current I/O buffer pointer
00662   8548 83 02DE            SUBD    #$02DE      ;Get # characters in buffer
00663   854B D7 D7              STB     <$D7        ;Hold # chars in edit buffer
00664   854D DC 2B              LDD     <$2B        ;Line number being edited
00665   854F BD BDCC            JSR     $BDCC       ;Cnvrt integer to ASCII & print
00666   8552 BD B9AC            JSR     $B9AC       ;Print blank
00667   8555 8E 02DD            LDX     #$02DD      ;=> buffer start
00668   8558 D6 D8              LDB     <$D8        ;Buffer needs printing?
00669   855A 26 25              BNE     $8581       ;If so, print it
00670   855C 5F                 CLRB                ;Init # input
00671   855D BD 8687            JSR     $8687       ;Get keyboard I/P chr for edit
00672   8560 BD 90AA            JSR     $90AA       ;Chr = "0" to "9" ?
00673   8563 25 0B              BLO     $8570       ;If not
00674   8565 80 30              SUBA    #$30        ;ASCII # to integer
00675   8567 34 02              PSHS    A           ;Save current #
00676   8569 86 0A              LDA     #$0A        ;Multiply previous #...
00677   856B 3D                 MUL                 ;...by 10
00678   856C EB E0              ADDB    ,S+         ;And add in current #
00679   856E 20 ED              BRA     $855D       ;Go again
00680   8570 C0 01              SUBB    #1          ;If # is 0 ...
00681   8572 C9 01              ADCB    #1          ;# becomes 1
00682   8574 81 41              CMPA    #$41        ;<A>bandon changes?
00683   8576 26 05              BNE     $857D       ;No
00684   8578 BD B958            JSR     $B958       ;Else print carriage return
00685   857B 20 BB              BRA     $8538       ;Start over
00686   857D 81 4C              CMPA    #$4C        ;<L>ist?
00687   857F 26 0B              BNE     $858C       ;If not, else...
00688   8581 8D 31              BSR     $85B4       ;Print buffer
00689   8583 0F D8              CLR     <$D8        ;Clear buffer print flag
00690   8585 BD B958            JSR     $B958       ;Print c/r
00691   8588 20 C3              BRA     $854D       ;Point to buffer, get key input
00692   858A 32 62              LEAS    2,S         ;Pull return address
00693   858C 81 0D              CMPA    #$0D        ;c/r?
00694   858E 26 0D              BNE     $859D       ;If not c/r
00695   8590 8D 22              BSR     $85B4       ;Print rest of line
00696   8592 BD B958            JSR     $B958       ;Print c/r
00697   8595 8E 02DD            LDX     #$02DD      ;=> buffer start
00698   8598 9F A6              STX     <$A6        ;To parse pointer
00699   859A 7E ACA8            JMP     $ACA8       ;Insrt to program as new line #
00700   859D 81 45              CMPA    #$45        ;<E>nd?
00701   859F 27 F1              BEQ     $8592       ;Same as c/r if so
00702   85A1 81 51              CMPA    #$51        ;<Q>uit?
00703   85A3 26 06              BNE     $85AB       ;If not
00704   85A5 BD B958            JSR     $B958       ;Print c/r
00705   85A8 7E AC73            JMP     $AC73       ;To direct mode
00706   85AB 8D 02              BSR     $85AF       ;Try active routines
00707   85AD 20 AD              BRA     $855C       ;Back to get #
00708   85AF 81 20              CMPA    #$20        ;Space character?
00709   85B1 26 10              BNE     $85C3       ;If not, else list B characters
```

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Line                Object
Number  Address     Code        Mnemonic  Operand     Jake's Comment

00710   85B3 8C     C6F9        CMPX      #$C6F9      ;Mask for following opcode
-----   85B4 C6     F9          LDB       #$F9        ;List 249 chrs
00711   85B6 A6     84          LDA       ,X          ;Character from buffer
00712   85B8 27     08          BEQ       $85C2       ;RTS if buffer end
00713   85BA BD     A282        JSR       $A282       ;Print character
00714   85BD 30     01          LEAX      1,X         ;Bump buffer pointer
00715   85BF 5A                 DECB                  ;Decrement tally
00716   85C0 26     F4          BNE       $85B6       ;Print next if more
00717   85C2 39                 RTS
00718   85C3 81     44          CMPA      #$44        ;<D>elete?
00719   85C5 26     48          BNE       $860F       ;No
00720   85C7 6D     84          TST       ,X          ;End of buffer?
00721   85C9 27     F7          BEQ       $85C2       ;RTS if so
00722   85CB 8D     04          BSR       $85D1       ;Delete character from line
00723   85CD 5A                 DECB                  ;1 less character to delete
00724   85CE 26     F7          BNE       $85C7       ;If more to do
00725   85D0 39                 RTS

Delete character from line
00726   85D1 0A     D7          DEC       <$D7        ;Decrement # chars in buffer
00727   85D3 31     1F          LEAY      -1,X        ;=> buffer-1
00728   85D5 31     21          LEAY      1,Y         ;=> buffer+1
00729   85D7 A6     21          LDA       1,Y         ;Character from next position
00730   85D9 A7     A4          STA       ,Y          ;Into this position
00731   85DB 26     F8          BNE       $85D5       ;Again if not end of line
00732   85DD 39                 RTS

00733   85DE 81     49          CMPA      #$49        ;<I>nsert?
00734   85E0 27     13          BEQ       $85F5       ;If so
00735   85E2 81     58          CMPA      #$58        ;e<X>tend?
00736   85E4 27     0D          BEQ       $85F3       ;If so
00737   85E6 81     48          CMPA      #$48        ;<H>ack?
00738   85E8 26     5C          BNE       $8646       ;If not
00739   85EA 6F     84          CLR       ,X          ;Delimit line
00740   85EC 1F     10          TFR       X,D         ;End of line to D
00741   85EE 83     02DE        SUBD      #$02DE      ;Minus start+1
00742   85F1 D7     D7          STB       <$D7        ;New # chars in edit buffer
00743   85F3 8D     BF          BSR       $85B4       ;Print rest of line
00744   85F5 BD     8687        JSR       $8687       ;Get key I/P character for edit
00745   85F8 81     0D          CMPA      #$0D        ;c/r?

00746   85FA 27     8E          BEQ       $858A       ;If so, pull ret address & exit
00747   85FC 81     1B          CMPA      #$1B        ;ESC?
00748   85FE 27     25          BEQ       $8625       ;RTS if so
00749   8600 81     08          CMPA      #8          ;Backspace?
00750   8602 26     22          BNE       $8626       ;If not
00751   8604 8C     02DD        CMPX      #$02DD      ;Buffer already at start?
00752   8607 27     EC          BEQ       $85F5       ;Go again if so
00753   8609 8D     45          BSR       $8650       ;Backspace buffer
00754   860B 8D     C4          BSR       $85D1       ;Delete character from line
00755   860D 20     E6          BRA       $85F5       ;Continue insert mode

Change
00756   860F 81     43          CMPA      #$43        ;<C>hange?
00757   8611 26     CB          BNE       $85DE       ;If not
00758   8613 6D     84          TST       ,X          ;End of line?
00759   8615 27     0E          BEQ       $8625       ;RTS if so

Line                Object
Number  Address     Code        Mnemonic  Operand     Jake's Comment

00760   8617 BD     8687        JSR       $8687       ;Get key I/P character for edit
00761   861A 25     02          BLO       $861E       ;If not control character
00762   861C 20     F5          BRA       $8613       ;Else ignore
00763   861E A7     80          STA       ,X+         ;Change to character I/P
00764   8620 8D     37          BSR       $8659       ;Print character
00765   8622 5A                 DECB                  ;# chars remaining to change
00766   8623 26     EE          BNE       $8613       ;Continue
00767   8625 39                 RTS

Insert
00768   8626 D6     D7          LDB       <$D7        ;# character in edit buffer
00769   8628 C1     F9          CMPB      #$F9        ;=249?
00770   862A 26     02          BNE       $862E       ;No, continue
00771   862C 20     C7          BRA       $85F5       ;Else ignore insert character
00772   862E 34     10          PSHS      X           ;Save pntr to insert position
00773   8630 6D     80          TST       ,X+         ;Check for EOL, bump pointer
00774   8632 26     FC          BNE       $8630       ;Go until end of line
00775   8634 E6     82          LDB       ,-X         ;Load last character
00776   8636 E7     01          STB       1,X         ;Store one forward
00777   8638 AC     E4          CMPX      ,S          ;At insert position?
00778   863A 26     F8          BNE       $8634       ;No, keep going
00779   863C 32     62          LEAS      2,S         ;Restore saved position
00780   863E A7     80          STA       ,X+         ;Insert character
00781   8640 8D     17          BSR       $8659       ;Print character
00782   8642 0C     D7          INC       <$D7        ;Bump # chars in edit buffer
00783   8644 20     AF          BRA       $85F5       ;Continue insert mode

00784   8646 81     08          CMPA      #8          ;Backspace?
00785   8648 26     12          BNE       $865C       ;If not
00786   864A 8D     04          BSR       $8650       ;Else backspace buffer
00787   864C 5A                 DECB                  ;# chars to backspace minus 1
00788   864D 26     FB          BNE       $864A       ;If more to do
00789   864F 39                 RTS

00790   8650 8C     02DD        CMPX      #$02DD      ;Already at buffer start?
00791   8653 27     D0          BEQ       $8625       ;RTS if so
00792   8655 30     1F          LEAX      -1,X        ;Backoff buffer pointer
00793   8657 86     08          LDA       #8          ;Backspace character
00794   8659 7E     A282        JMP       $A282       ;Print & RTS

00795   865C 81     4B          CMPA      #$4B        ;<K>ill?
00796   865E 27     05          BEQ       $8665       ;If so
00797   8660 80     53          SUBA      #$53        ;<S>earch?
00798   8662 27     01          BEQ       $8665       ;If so
00799   8664 39                 RTS                   ;Unsupported edit command

00800   8665 34     02          PSHS      A           ;Save "K" or "S" (=0 if "S")
00801   8667 8D     1E          BSR       $8687       ;Get key I/P character for edit
00802   8669 34     02          PSHS      A           ;Save search character
00803   866B A6     84          LDA       ,X          ;Get current buffer character
00804   866D 27     16          BEQ       $8685       ;Out if end of line
00805   866F 6D     61          TST       1,S         ;"S" or "K" ?
00806   8671 26     06          BNE       $8679       ;If "K"
00807   8673 8D     E4          BSR       $8659       ;Print current character
00808   8675 30     01          LEAX      1,X         ;Bump buffer pointer
00809   8677 20     03          BRA       $867C
00810   8679 BD     85D1        JSR       $85D1       ;Delete character from buffer
```

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Line                    Object
Number  Address  Code           Mnemonic  Operand   Jake's Comment

00811  867C A6 84          LDA   ,X        ;Current character
00812  867E A1 E4          CMPA  ,S        ;This search character?
00813  8680 26 E9          BNE   $866B     ;No, keep going
00814  8682 5A             DECB            ;This the occurrence required?
00815  8683 26 E6          BNE   $866B     ;No, keep going
00816  8685 35 A0          PULS  Y,PC      ;Pull info & RTS

Get keyboard I/P character for edit
00817  8687 BD A171        JSR   $A171     ;Get I/P character, chop bit 7
00818  868A 81 7F          CMPA  #$7F      ;>$7F? (impossible)
00819  868C 24 F9          BHS   $8687     ;Again if so
00820  868E 81 5F          CMPA  #$5F      ;Shift/up arrow?
00821  8690 26 02          BNE   $8694     ;If not
00822  8692 86 1B          LDA   #$1B      ;Else replace with ESC code
00823  8694 81 0D          CMPA  #$0D      ;c/r?
00824  8696 27 0E          BEQ   $86A6     ;RTS if c/r
00825  8698 81 1B          CMPA  #$1B      ;ESC?
00826  869A 27 0A          BEQ   $86A6     ;RTS if ESC
00827  869C 81 08          CMPA  #8        ;Backspace?
00828  869E 27 06          BEQ   $86A6     ;RTS if backspace
00829  86A0 81 20          CMPA  #$20      ;Other control code?
00830  86A2 25 E3          BLO   $8687     ;Ignore if so
00831  86A4 1A 01          ORCC  #1        ;Set carry if not control
00832  86A6 39             RTS

TRON / TROFF
00833  86A7 86 4F          LDA   #$4F      ;=$4F for TRON, 0 for TROFF
00834  86A9 97 AF          STA   <$AF      ;Save trace status
00835  86AB 39             RTS

POS
00836  86AC 96 6F          LDA   <$6F      ;Device number
00837  86AE 34 02          PSHS  A         ;Save it
00838  86B0 BD A5AE        JSR   $A5AE     ;Get specified device number
00839  86B3 BD A406        JSR   $A406     ;Check file open for output
00840  86B6 BD A35F        JSR   $A35F     ;Initialize output file
00841  86B9 D6 6C          LDB   <$6C      ;Print position
00842  86BB 7E A5E4        JMP   $A5E4     ;Rstr dev #, return integer

VARPTR
00843  86BE BD B26A        JSR   $B26A     ;Syntax check for "("
00844  86C1 DC 1F          LDD   <$1F      ;=> top of variables
00845  86C3 34 06          PSHS  A,B       ;Save pointer
00846  86C5 BD B357        JSR   $B357     ;Find or assign variable
00847  86C8 BD B267        JSR   $B267     ;Syntax check for ")"
00848  86CB 35 06          PULS  A,B       ;Get previous top of variables
00849  86CD 1E 10          EXG   X,D       ;Poss ptr to D, top vrbls to X
00850  86CF 9C 1F          CMPX  <$1F      ;Top of vrbles still the same?
00851  86D1 26 51          BNE   $8724     ;?FC Error if not
00852  86D3 7E B4F4        JMP   $B4F4     ;Return 2 bytes from D

MID$=
00853  86D6 9D 9F          JSR   <$9F      ;Parse next character
00854  86D8 BD B26A        JSR   $B26A     ;Syntax check for "("
00855  86DB BD B357        JSR   $B357     ;Find or assign variable
00856  86DE 34 10          PSHS  X         ;Save varptr
00857  86E0 EC 02          LDD   2,X       ;Get string pointer

Line                    Object
Number  Address  Code           Mnemonic  Operand   Jake's Comment

00858  86E2 109321        CMPD  <$21      ;String below stack?
00859  86E5 23 04          BLS   $86EB     ;Yes, get to mem string space
00860  86E7 93 27          SUBD  <$27      ;String below HIGH$?
00861  86E9 23 12          BLS   $86FD     ;Yes, must be in mem strng spce
00862  86EB E6 84          LDB   ,X        ;String length
00863  86ED BD B56D        JSR   $B56D     ;Get next memory string space
00864  86F0 34 10          PSHS  X         ;Save it
00865  86F2 AE 62          LDX   2,S       ;Get varptr
00866  86F4 BD B643        JSR   $B643     ;Copy string to memory
00867  86F7 35 50          PULS  X,U       ;Mem strg ptr to X, varptr to U
00868  86F9 AF 42          STX   2,U       ;New string pointer to varptr
00869  86FB 34 40          PSHS  U         ;Save varptr
00870  86FD BD B738        JSR   $B738     ;Get "," & # <256 to B
00871  8700 34 04          PSHS  B         ;Save start position
00872  8702 5D             TSTB            ;Is it zero?
00873  8703 27 1F          BEQ   $8724     ;?FC Error if so
00874  8705 C6 FF          LDB   #$FF      ;Init deflt # chrs to chng=255
00875  8707 81 29          CMPA  #$29      ;Current chr = ")"?
00876  8709 27 03          BEQ   $870E     ;Yes, use default # chrs
00877  870B BD B738        JSR   $B738     ;Get "," & # <256 to B
00878  870E 34 04          PSHS  B         ;Save # characters to change
00879  8710 BD B267        JSR   $B267     ;Syntax check for ")"
00880  8713 C6 B3          LDB   #$B3      ;"=" token
00881  8715 BD B26F        JSR   $B26F     ;Syntax check for "="
00882  8718 8D 2E          BSR   $8748     ;Compute exprssn on right side
00883  871A 1F 13          TFR   X,U       ;RHS string varptr to U
00884  871C AE 62          LDX   2,S       ;LHS string varptr to X
00885  871E A6 84          LDA   ,X        ;LHS string length
00886  8720 A0 61          SUBA  1,S       ;Minus start position
00887  8722 24 03          BHS   $8727     ;OK if strt<= # chrs at RHS
00888  8724 7E B44A        JMP   $B44A     ;Else ?FC Error
00889  8727 4C             INCA            ;# chrs available to change
00890  8728 A1 E4          CMPA  ,S        ;# requested > # available?
00891  872A 24 02          BHS   $872E     ;OK if not
00892  872C A7 E4          STA   ,S        ;Else use # available
00893  872E A6 61          LDA   1,S       ;Get start position
00894  8730 1E 89          EXG   A,B       ;Strt posn->B, # chrs on RHS->A
00895  8732 AE 02          LDX   2,X       ;String pointer to X
00896  8734 5A             DECB            ;Offset strt position to zero
00897  8735 3A             ABX             ;Point to lst char to change
00898  8736 4D             TSTA            ;# characters in RHS string
00899  8737 27 0D          BEQ   $8746     ;Forget all if RHS strng null
00900  8739 A1 E4          CMPA  ,S        ;# RHS chrs <= # chrs to chng?
00901  873B 23 02          BLS   $873F     ;OK if so
00902  873D A6 E4          LDA   ,S        ;Else just change # chrs spec'd
00903  873F 1F 89          TFR   A,B       ;# chrs to change to B
00904  8741 1E 31          EXG   U,X       ;Get src & dest right way round
00905  8743 BD A59A        JSR   $A59A     ;Copy new bytes into position
00906  8746 35 96          PULS  A,B,X,PC  ;Restore regs & RTS
00907  8748 BD B156        JSR   $B156     ;Compute expression
00908  874B 7E B654        JMP   $B654     ;Get str expr ptr->X, # chrs->B

STRING$
00909  874E BD B26A        JSR   $B26A     ;Syntax check for "("
00910  8751 BD B70B        JSR   $B70B     ;Compute # <256
00911  8754 34 04          PSHS  B         ;Save string length
00912  8756 BD B26D        JSR   $B26D     ;Syntax check for ","
```

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Line                    Object
Number  Address         Code        Mnemonic  Operand   Jake's Comment

00913   8759 BD B156            JSR   $B156     ;Compute expression
00914   875C BD B267            JSR   $B267     ;Syntax check for ")"
00915   875F 96 06              LDA   <6        ;Variable type
00916   8761 26 05              BNE   $8768     ;If string
00917   8763 BD B70E            JSR   $B70E     ;Get integer to B
00918   8766 20 03              BRA   $876B
00919   8768 BD B6A4            JSR   $B6A4     ;Get LEFT$ character to B
00920   876B 34 04              PSHS  B         ;Save repeat chr
00921   876D E6 61              LDB   1,S       ;Repeat tally = string length
00922   876F BD B50F            JSR   $B50F     ;Get next mem string space
00923   8772 35 06              PULS  A,B       ;A=chr, B=length
00924   8774 27 05              BEQ   $877B     ;If string length = 0
00925   8776 A7 80              STA   ,X+       ;Save chr in string
00926   8778 5A                 DECB            ;Decrement tally
00927   8779 26 FB              BNE   $8776     ;Continue until done
00928   877B 7E B69B            JMP   $B69B     ;Update string stack

INSTR
00929   877E BD B26A            JSR   $B26A     ;Syntax check for "("
00930   8781 BD B156            JSR   $B156     ;Compute expression
00931   8784 C6 01              LDB   #1        ;Default start position
00932   8786 34 04              PSHS  B         ;Save it
00933   8788 96 06              LDA   <6        ;Variable type
00934   878A 26 10              BNE   $879C     ;If $, no strt posn was given
00935   878C BD B70E            JSR   $B70E     ;Get integer to B
00936   878F E7 E4              STB   ,S        ;Replace default start position
00937   8791 27 91              BEQ   $8724     ;?FC Error if zero
00938   8793 BD B26D            JSR   $B26D     ;Syntax check for ","
00939   8796 BD B156            JSR   $B156     ;Compute expression
00940   8799 BD B146            JSR   $B146     ;?TM Error if not string
00941   879C 9E 52              LDX   <$52      ;String varptr
00942   879E 34 10              PSHS  X         ;Save it
00943   87A0 BD B26D            JSR   $B26D     ;Syntax check for ","
00944   87A3 BD 8748            JSR   $8748     ;Get str ptr to X, # chrs to B
00945   87A6 34 14              PSHS  B,X       ;Save target-string parameters
00946   87A8 BD B267            JSR   $B267     ;Syntax check for ")"
00947   87AB AE 63              LDX   3,S       ;Search-string varptr
00948   87AD BD B659            JSR   $B659     ;Get str ptr to X, # chrs to B
00949   87B0 34 04              PSHS  B         ;Save # chrs in search string
00950   87B2 E1 66              CMPB  6,S       ;# search chrs < strt posn?
00951   87B4 25 23              BLO   $87D9     ;Return zero if so
00952   87B6 A6 61              LDA   1,S       ;Get target string length
00953   87B8 27 1C              BEQ   $87D6     ;If zero, return start position
00954   87BA E6 66              LDB   6,S       ;Get start position for search
00955   87BC 5A                 DECB            ;Offset to zero
00956   87BD 3A                 ABX             ;Point X at srch $ strt posn
00957   87BE 31 84              LEAY  ,X        ;Hold strt posn in Y
00958   87C0 EE 62              LDU   2,S       ;Pointer to target string
00959   87C2 E6 61              LDB   1,S       ;Target string length
00960   87C4 A6 E4              LDA   ,S        ;Search string length
00961   87C6 A0 66              SUBA  6,S       ;Minus strt posn
00962   87C8 4C                 INCA            ;= # chrs available to scan
00963   87C9 A1 61              CMPA  1,S       ;# chrs available < target len?
00964   87CB 25 0C              BLO   $87D9     ;Return zero if so
00965   87CD A6 80              LDA   ,X+       ;Chr from search string
00966   87CF A1 C0              CMPA  ,U+       ;Same as target string?
00967   87D1 26 0C              BNE   $87DF     ;If match fails

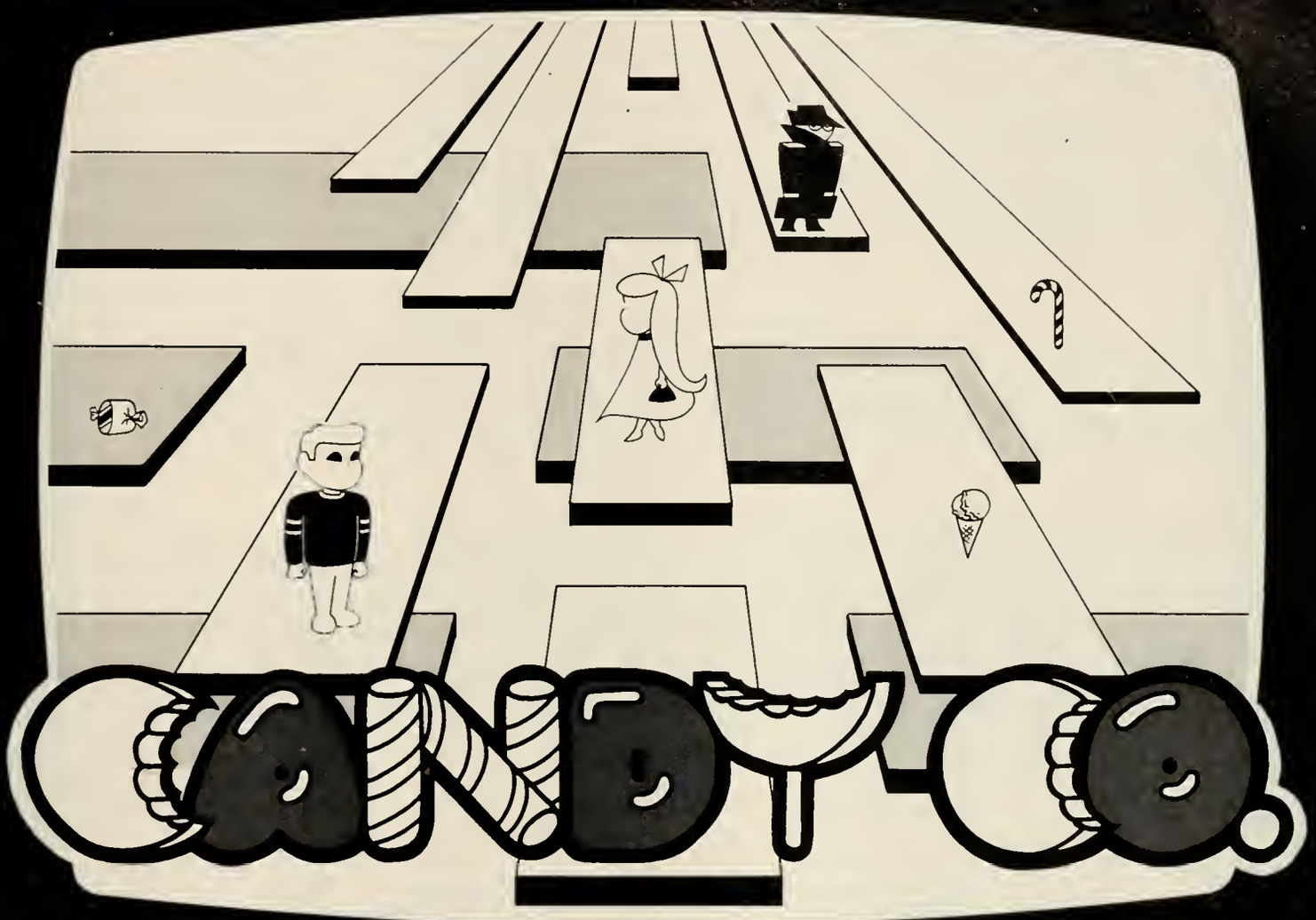
Line                    Object
Number  Address         Code        Mnemonic  Operand   Jake's Comment

00968   87D3 5A                 DECB            ;Matched all characters?
00969   87D4 26 F7              BNE   $87CD     ;No, go again
00970   87D6 E6 66              LDB   6,S       ;Start position of match
00971   87D8 21 5F              BRN   $8839     ;87D9=CLRB (return zero val)
00972   87DA 32 67              LEAS  7,S       ;Pull all parameters
00973   87DC 7E B4F3            JMP   $B4F3     ;Return 1 byte integer
00974   87DF 6C 66              INC   6,S       ;Bump search position
00975   87E1 30 21              LEAX  1,Y       ;Bump search string ptr
00976   87E3 20 D9              BRA   $87BE     ;Restart search

00977   87E5 81 26              CMPA  #$26      ;"&"?
00978   87E7 26 5C              BNE   $8845     ;RTS if not
00979   87E9 32 62              LEAS  2,S       ;Pull return
00980   87EB 0F 52              CLR   <$52      ;Init running...
00981   87ED 0F 53              CLR   <$53      ;... total = 0
00982   87EF 8E 0052            LDX   #$0052    ;=> resultant integer
00983   87F2 9D 9F              JSR   <$9F      ;Parse next chr
00984   87F4 81 4F              CMPA  #$4F      ;<O>ctal?
00985   87F6 27 12              BEQ   $880A     ;If so
00986   87F8 81 48              CMPA  #$48      ;<H>exadecimal?
00987   87FA 27 23              BEQ   $881F     ;If so
00988   87FC 9D A5              JSR   <$A5      ;Parse current chr
00989   87FE 20 0C              BRA   $880C
00990   8800 81 38              CMPA  #$38      ;# > 8? (bug)
00991   8802 1022 2A71          LBHI  $B277     ;?SN Error if so
00992   8806 C6 03              LDB   #3        ;# bits per digit
00993   8808 8D 2A              BSR   $8834     ;Add digit to running total
00994   880A 9D 9F              JSR   <$9F      ;Parse next chr
00995   880C 25 F2              BLO   $8800     ;If ASCII 0-9
00996   880E 0F 50              CLR   <$50      ;Zero...
00997   8810 0F 51              CLR   <$51      ;MSBs
00998   8812 0F 06              CLR   <6        ;Set variable type numeric
00999   8814 0F 63              CLR   <$63      ;Zero F.P. carry
01000   8816 0F 54              CLR   <$54      ;Make number positive
01001   8818 C6 A0              LDB   #$A0      ;Make exponent...
01002   881A D7 4F              STB   <$4F      ;... = 32
01003   881C 7E BA1C            JMP   $BA1C     ;F.P. Normalize

&H
01004   881F 9D 9F              JSR   <$9F      ;Parse next chr
01005   8821 25 0B              BLO   $882E     ;If ASCII 0 - 9
01006   8823 BD B3A2            JSR   $B3A2     ;Chr = "A" - "Z"?
01007   8826 25 E6              BLD   $880E     ;Out if not A-Z
01008   8828 81 47              CMPA  #$47      ;>= "G"?
01009   882A 24 E2              BHS   $880E     ;Out if not A-F
01010   882C 80 07              SUBA  #7        ;Make 41-46 = 3A-3F
01011   882E C6 04              LDB   #4        ;# bits per digit
01012   8830 8D 02              BSR   $8834     ;Add digit to running total
01013   8832 20 EB              BRA   $881F     ;Continue
01014   8834 68 01              ASL   1,X       ;Shift...
01015   8836 69 84              ROL   ,X        ;...running total
01016   8838 1025 3256          LBLO  $BA92     ;?OV Error if carry
01017   883C 5A                 DECB            ;Done whole digit?
01018   883D 26 F5              BNE   $8834     ;Keep shifting until room
01019   883F 80 30              SUBA  #$30      ;Convert chr to hex/octal
01020   8841 AB 01              ADDA  1,X       ;Add running total
01021   8843 A7 01              STA   1,X       ;Put back to running total
```

Setting The Standards



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```
Line                    Object
Number  Address  Code           Mnemonic  Operand   Jake's Comment

01022   8845 39                RTS

01023   8846 35 40             PULS  U           ;Hold return address
01024   8848 0F 06             CLR   <6          ;Set vrbl type = numeric
01025   884A 9E A6             LDX   <$A6        ;Hold Parse pointer
01026   884C 9D 9F             JSR   <$9F        ;Parse next chr
01027   884E 81 26             CMPA  #$26        ;"&"?
01028   8850 27 99             BEQ   $87EB       ;If so, do oct/hex conversion

01029   8852 81 CC             CMPA  #$CC        ;FN?
01030   8854 27 5E             BEQ   $88B4       ;If so
01031   8856 81 FF             CMPA  #$FF        ;RHS function?
01032   8858 26 08             BNE   $8862       ;Out if so
01033   885A 9D 9F             JSR   <$9F        ;Parse next chr
01034   885C 81 83             CMPA  #$83        ;USR?
01035   885E 1027 00CA         LBEQ  $892C       ;If so
01036   8862 9F A6             STX   <$A6        ;Restore parse ptr
01037   8864 6E C4             JMP   ,U          ;Return

Check not direct mode
01038   8866 9E 68             LDX   <$68        ;=> current statement line #
01039   8868 30 01             LEAX  1,X         ;=$FFFF?
01040   886A 26 D9             BNE   $8845       ;RTS if not
01041   886C C6 16             LDB   #$16        ;Err code
01042   886E 7E AC46           JMP   $AC46       ;Error processing

DEF
01043   8871 AE 9F00A6         LDX   (00A6)      ;Parse pointer contents
01044   8875 8C FF83           CMPX  #$FF83      ;DEFUSR?
01045   8878 1027 0093         LBEQ  $890F       ;Yes
01046   887C 8D 23             BSR   $88A1       ;Find/assign # FN name
01047   887E 8D E6             BSR   $8866       ;Check not direct mode
01048   8880 BD B26A           JSR   $B26A       ;SN check for ","
01049   8883 C6 80             LDB   #$80        ;Mask off...
01050   8885 D7 08             STB   <8          ;...array assignment
01051   8887 BD B357           JSR   $B357       ;Find or assign variable
01052   888A 8D 25             BSR   $88B1       ;Numeric TM error check
01053   888C BD B267           JSR   $B267       ;Syntax check ")"
01054   888F C6 B3             LDB   #$B3        ;"=" token
01055   8891 BD B26F           JSR   $B26F       ;Syntax check for "="
01056   8894 9E 4B             LDX   <$4B        ;FN name varptr
01057   8896 DC A6             LDD   <$A6        ;Current parse ptr
01058   8898 ED 84             STD   ,X          ;as variable val
01059   889A DC 39             LDD   <$39        ;Bracketed FN vrbl varptr
01060   889C ED 02             STD   2,X         ;Save in FN name variable
01061   889E 7E AEE0           JMP   $AEE0       ;Jump over to next statement

Find/assign FN "name" variable
01062   88A1 C6 CC             LDB   #$CC        ;"FN" token
01063   88A3 BD B26F           JSR   $B26F       ;Syntax check for FN
01064   88A6 C6 80             LDB   #$80        ;Mask to prevent...
01065   88A8 D7 08             STB   <8          ;...array assignment
01066   88AA 8A 80             ORA   #$80        ;Set bit 7 in lst vrble letter
01067   88AC BD B35C           JSR   $B35C       ;Find/assign FN name
01068   88AF 9F 4B             STX   <$4B        ;Save FN name varptr
01069   88B1 7E B143           JMP   $B143       ;Numeric TM error check
```

```
Line                    Object
Number  Address  Code           Mnemonic  Operand   Jake's Comment

FN
01070   88B4 8D EB             BSR   $88A1       ;Find/assign FN name
01071   88B6 34 10             PSHS  X           ;FN name varptr
01072   88B8 BD B262           JSR   $B262       ;Syntax check "("
01073   88BB 8D F4             BSR   $88B1       ;Numeric TM error check
01074   88BD 35 40             PULS  U           ;FN name varptr
01075   88BF C6 32             LDB   #$32        ;Possible error code
01076   88C1 AE 42             LDX   2,U         ;FN variable ptr
01077   88C3 27 A9             BEQ   $886E       ;Error if FN vrbl not defined
01078   88C5 109EA6            LDY   <$A6        ;Hold current parse ptr
01079   88C8 EE C4             LDU   ,U          ;Get FN parse ptr
01080   88CA DF A6             STU   <$A6        ;Place into parse routine
01081   88CC A6 04             LDA   4,X         ;Current FN variable LSB
01082   88CE 34 02             PSHS  A           ;Save LSB
01083   88D0 EC 84             LDD   ,X          ;Current FN vrbl exp + MSB
01084   88D2 EE 02             LDU   2,X         ;Current FN vrbl next MSW
01085   88D4 34 76             PSHS  A,B,X,Y,U   ;Save value/ptr/parse ptr
01086   88D6 BD BC35           JSR   $BC35       ;FPAC1 to X, FN vrbl to place
01087   88D9 BD B141           JSR   $B141       ;Compute # vrbl to FPAC1
01088   88DC 35 76             PULS  A,B,X,Y,U   ;Restore previous vrbl
01089   88DE ED 84             STD   ,X          ;Prev exp + MSB
01090   88E0 EF 02             STU   2,X         ;Prev next MSW
01091   88E2 35 02             PULS  A           ;LSB
01092   88E4 A7 04             STA   4,X         ;Restore LSB
01093   88E6 9D A5             JSR   <$A5        ;Parse current chr
01094   88E8 1026 298B         LBNE  $B277       ;?SN Error if not end statement
01095   88EC 109FA6            STY   <$A6        ;Restore parse ptr
01096   88EF 39                RTS

Extended error processing
01097   88F0 C1 32             CMPB  #$32        ;Error code < 50?
01098   88F2 25 FB             BLO   $88EF       ;RTS if so
01099   88F4 BD A7E9           JSR   $A7E9       ;Cassette motor off
01100   88F7 BD A974           JSR   $A974       ;Audio off
01101   88FA BD AD33           JSR   $AD33       ;Reset str stk & CONT ptr
01102   88FD 0F 6F             CLR   <$6F        ;Reset device number
01103   88FF BD B95C           JSR   $B95C       ;Print c/r if necessary
01104   8902 BD B9AF           JSR   $B9AF       ;Print "?"
01105   8905 8E 88D9           LDX   #$88D9      ;=> error codes (wrong)
01106   8908 7E AC60           JMP   $AC60       ;Print error code
01107   890B 55                                  ;U
01108   890C 46                RORA              ;F
01109   890D 4E                                  ;N
01110   890E 45                                  ;E

DEFUSRn
01111   890F 9D 9F             JSR   <$9F        ;Parse next chr past $83
01112   8911 8D 09             BSR   $891C       ;Get usr # ptr to X
01113   8913 34 10             PSHS  X           ;Save ptr to usr address
01114   8915 8D 2D             BSR   $8944       ;Get specified address
01115   8917 35 40             PULS  U           ;USR ptr
01116   8919 AF C4             STX   ,U          ;Save USR address
01117   891B 39                RTS

Get USRn pointer to X
01118   891C 5F                CLRB              ;Initialize USR #
01119   891D 9D 9F             JSR   <$9F        ;Parse next chr
```

```
Line                  Object
Number  Address       Code          Mnemonic  Operand   Jake's Comment

01120   891F 24 06          BHS   $8927     ;If not ASCII 0-9
01121   8921 80 30          SUBA  #$30      ;Else ASCII to integer
01122   8923 1F 89          TFR   A,B       ;USR# to B
01123   8925 9D 9F          JSR   <$9F      ;Parse next chr
01124   8927 9E B0          LDX   <$B0      ;=> USR table
01125   8929 58             ASLB            ;USR# times 2 bytes per entry
01126   892A 3A             ABX             ;Point X to USR # address
01127   892B 39             RTS

USR
01128   892C 8D EE          BSR   $891C     ;Get USR # ptr in X
01129   892E AE 84          LDX   ,X        ;Get USR # address
01130   8930 34 10          PSHS  X         ;Push address for RTS
01131   8932 BD B262        JSR   $B262     ;Compute expression in brackets
01132   8935 8E 004F        LDX   #$004F    ;=> F.P. number
01133   8938 96 06          LDA   <6        ;Numeric variable?
01134   893A 27 07          BEQ   $8943     ;Goto it if so
01135   893C BD B657        JSR   $B657     ;Else str varptr->X, # chrs->B
01136   893F 9E 52          LDX   <$52      ;String pointer
01137   8941 96 06          LDA   <6        ;Vrbl type
01138   8943 39             RTS             ;To USR
01139   8944 C6 B3          LDB   #$B3      ;"=" token
01140   8946 BD B26F        JSR   $B26F     ;Syntax check for "="
01141   8949 7E B73D        JMP   $B73D     ;Compute expression <65536 to X

Update timer
01142   894C B6 FF03        LDA   $FF03     ;Field sync interrupt?
01143   894F 2B 01          BMI   $8952     ;If so
01144   8951 3B             RTI             ;Else ignore it
01145   8952 B6 FF02        LDA   $FF02     ;Keyboard column
01146   8955 BE 0112        LDX   $0112     ;Current timer value
01147   8958 30 01          LEAX  1,X       ;+1
01148   895A BF 0112        STX   $0112     ;Update timer value
01149   895D 7E 9C3E        JMP   $9C3E     ;check if note being played

TIMER=
01150   8960 9D 9F          JSR   <$9F      ;Parse next chr
01151   8962 8D E0          BSR   $8944     ;Get # after "=" to X
01152   8964 BF 0112        STX   $0112     ;Set timer in mem
01153   8967 39             RTS

TIMER
01154   8968 BE 0112        LDX   $0112     ;Timer value
01155   896B 9F 52          STX   <$52      ;Hold value
01156   896D 7E 880E        JMP   $880E     ;Return as F.P. #

01157   8970 1027 2AD6      LBEQ  $B44A     ;?FC Error if end of line
01158   8974 BD AF67        JSR   $AF67     ;ASCII string to INT in <$2B
01159   8977 BD AD01        JSR   $AD01     ;Search for line # in <$2B
01160   897A 9F D3          STX   <$D3      ;Save pointer
01161   897C 9D A5          JSR   <$A5      ;Parse current chr
01162   897E 27 10          BEQ   $8990     ;If end of line
01163   8980 81 AC          CMPA  #$AC      ;Hyphen?
01164   8982 26 3B          BNE   $89BF     ;RTS if not
01165   8984 9D 9F          JSR   <$9F      ;Parse next chr
01166   8986 27 04          BEQ   $898C     ;If end of line
01167   8988 8D 24          BSR   $89AE     ;ASCII strng to integer in <$2B

Line                  Object
Number  Address       Code          Mnemonic  Operand   Jake's Comment

01168   898A 20 04          BRA   $8990
01169   898C 86 FF          LDA   #$FF      ;Setup high line #
01170   898E 97 2B          STA   <$2B      ;As end line #
01171   8990 DE D3          LDU   <$D3      ;Get link pointr for start line
01172   8992 8C EEC4        CMPX  #$EEC4    ;Hides 8993 instrctn
-----   8993 EE C4          LDU   ,U        ;Update to next link pointer
01173   8995 EC C4          LDD   ,U        ;Next line link
01174   8997 27 06          BEQ   $899F     ;If end prog
01175   8999 EC 42          LDD   2,U       ;Line #
01176   899B 93 2B          SUBD  <$2B      ;This the one?
01177   899D 23 F4          BLS   $8993     ;No, try again
01178   899F 9E D3          LDX   <$D3      ;Else get link ptr fr strt line
01179   89A1 8D 15          BSR   $89B8     ;Copy program down to here
01180   89A3 BD AD21        JSR   $AD21     ;Reset vrbl pointers
01181   89A6 9E D3          LDX   <$D3      ;=> current line
01182   89A8 BD ACF1        JSR   $ACF1     ;Reset link pointers from here
01183   89AB 7E AC73        JMP   $AC73     ;To direct mode
01184   89AE BD AF67        JSR   $AF67     ;ASCII to integer in <$2B
01185   89B1 7E A5C7        JMP   $A5C7     ;Check for end of line

Copy until end of Basic
01186   89B4 A6 C0          LDA   ,U+       ;1 byte from source & bump
01187   89B6 A7 80          STA   ,X+       ;1 byte to dest & bump
01188   89B8 11931B         CMPU  <$1B      ;At end of Basic?
01189   89BB 26 F7          BNE   $89B4     ;Cont if not
01190   89BD 9F 1B          STX   <$1B      ;Save new end of Basic
01191   89BF 39             RTS

LINE INPUT
01192   89C0 BD 8866        JSR   $8866     ;Check not direct mode
01193   89C3 9D 9F          JSR   <$9F      ;Parse next chr
01194   89C5 81 23          CMPA  #$23      ;"#"?
01195   89C7 26 09          BNE   $89D2     ;No
01196   89C9 BD A5A5        JSR   $A5A5     ;Get specified device #
01197   89CC BD A3ED        JSR   $A3ED     ;Check file open for input
01198   89CF BD B26D        JSR   $B26D     ;Syntax check for ","
01199   89D2 81 22          CMPA  #$22      ;Open quotes?
01200   89D4 26 0B          BNE   $89E1     ;If not
01201   89D6 BD B244        JSR   $B244     ;Quoted string to string stack
01202   89D9 C6 3B          LDB   #$3B      ;";"
01203   89DB BD B26F        JSR   $B26F     ;Syntax check for ";"
01204   89DE BD B99F        JSR   $B99F     ;Print string
01205   89E1 32 7E          LEAS  -2,S      ;Adj stack incase Brk durng I/P
01206   89E3 BD B035        JSR   $B035     ;Input chrs to buffer
01207   89E6 32 62          LEAS  2,S       ;Re-adjust stack
01208   89E8 0F 6F          CLR   <$6F      ;Reset device #
01209   89EA BD B357        JSR   $B357     ;Find/assign variable
01210   89ED 9F 3B          STX   <$3B      ;Hold varptr
01211   89EF BD B146        JSR   $B146     ;?TM Error if not string vrbl
01212   89F2 8E 02DC        LDX   #$02DC    ;=> Input buffer-1
01213   89F5 4F             CLRA            ;Delimiter = zero byte
01214   89F6 BD B51A        JSR   $B51A     ;String info to string stack
01215   89F9 7E AFA4        JMP   $AFA4     ;Assign string to variable
01216   89FC BD AF76        JSR   $AF67     ;ASCII # strg to intgr in <$2B
01217   89FF 9E 2B          LDX   <$2B      ;Integer to X
01218   8A01 39             RTS
```

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Logo

Take a turtle, move it forward, turn it left, add a child — fun and learning!

by J. Craig Dickinson

SOME SUBJECTS TRANSCEND age barriers. An eight year old can talk to an eighty year old about weather, ice cream, or baseball ... and Logo.

Since its creation in 1968 at M.I.T., Logo has been under continual development. Logo is a complex and sophisticated language; most Logo development during the 1970's was conducted using large research computer systems. In 1979 the M.I.T. Logo group began to adapt Logo to the TI 99/4 and to the Apple II microcomputers. Today, Logo is the rage of the educational computing community, and is fast becoming a required feature of every elementary school computing facility. Versions of Logo are available for every major microcomputer system. Spin-off "turtle graphics" software is being sold even in popular bookstores.

Origins

To truly recognize the impact of Logo as a computer language, one should consider that it was constructed by a team of programmers who were well versed in a language called *LISP* (LISt Processing language). Lisp was one of the earliest "higher level" computer languages. It was written by a man named John McCarthy in the '50s and has dominated the artificial intelligence field ever since. (Articifial intelligence is a method of hardware and programming that lets a computer emulate human thought processes.)

Lisp is a very strange language, using peculiar notation and lots of parentheses, but it's very powerful. It does have drawbacks. It gobbles memory, which is the main reason there have not been any good Lisps for micros. It is also an extremely difficult language to learn from books. Apparently one has to keep working at it until something about it clicks in your mind. If you don't work with it every day, it's easy to forget the quirks of the language. But, most importantly, Lisp is a hybrid language. It has the capability of both interactive-interpretive mode and compiled mode. It was perhaps this aspect of Lisp that most attracted the man usually recognized as the father of Logo, Seymour Papert.

Papert studied with the renowned Swiss psychologist, Jean Piaget. Piaget sees children as innately gifted learners who acquire vast quantities of knowledge before reaching school age. This "learning without being taught" remains in the forefront of all Logo philosophy, for the language is meant to be explored by the user.

Papert believes a programming language for children should relate to the real world in which they live. All kids know how to move around — this is

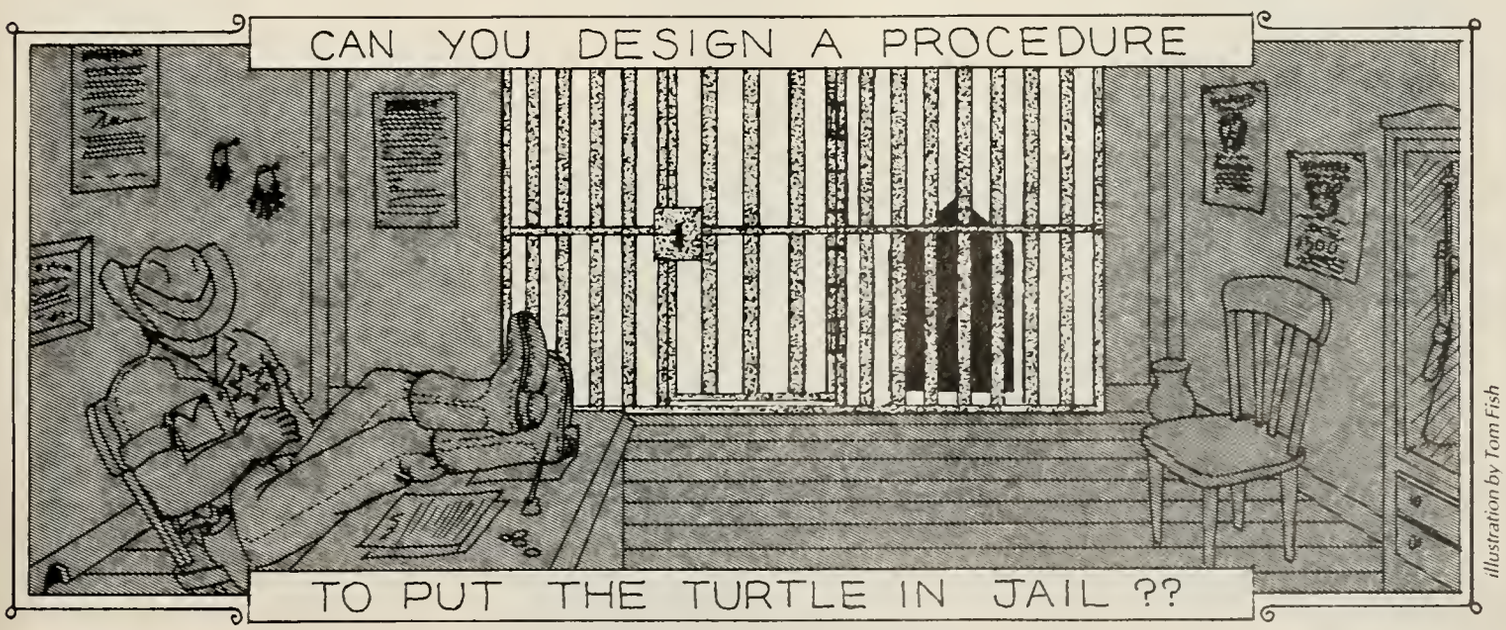


Illustration by Tom Fish

familiar territory to everyone. Papert and his collaborators looked to the computer to provide an environment in which a person could learn by doing and *then* think about what they just did. A child can actively explore the capabilities of Logo and the computer by constructing objects and then debugging them.

Amazing, to many observers, has been the appeal of this process to learners in all age groups. When James Muller founded the Young People's Logo Association in the summer of 1981, he thought his group would be corresponding with children who were already using Logo in their classes. He was surprised when publicity generated interest from all over the world from people of all ages using all types of computers. Papert himself alluded to his surprise at the widespread use of the language on the PBS show *NOVA*: "Logo was originally intended to be a vehicle to introduce programming to young children, but what's good for thinking is good for thinking."

I purchased a Color Logo ROMpak from Radio Shack as soon as they became available in April of '83. At that time the Radio Shack version was the least expensive Logo package, requiring only 16K of memory, and had most of the graphics capabilities of the original system. I soon ran into the major hurdle all Logo instructors must face: when was I going to get a chance to use it?

An example. Last fall I smuggled a Color Computer 2, with my friendly Logo package, home for the weekend. The problem with trying to learn Logo as an adult in an elementary school is that kids keep showing up to play. So, on a rainy November Sunday, I settled myself in front of the television set for a marathon Logo session. My wife, Paula, joined me. She was going to stay for just a few moments. Before I knew it, she was off on an hour-long romp in the Doodle mode, composing a screen full of cats and printing a brief story line at the bottom. Her teenage daughter, Julie, and friend, Rachel, neither of whom had ever programmed, then collaborated on a detailed drawing of a cross country skier against a mountain background. Two hours later it occurred to one of them to ask what time it was. Time and time again I have seen the seductive lure of the turtle thoroughly distract people of all ages.

What's A Turtle?

The turtle is a small pointer resembling a pencil stub that appears in the middle of the screen when you're using Color Logo. It responds to a few simple com-

mands. FORWARD moves the turtle in the direction it is facing the number of units you specify. If you type the command FORWARD 50, the turtle will respond by moving forward 50 turtle steps (about ¼ the height of the screen, total). RIGHT (abbreviated RT) rotates the turtle clockwise a given number of degrees. BACK and LEFT cause movements opposite to Forward and Right. The turtle carries a pen in its travels, which leaves a trace of its path on the screen as it moves when the pen is down. The commands PENUP and PENDOWN direct the turtle to raise or lower the pen.

Beginners enjoy using these commands, but to really make progress you have to teach the computer new command words. For instance, you can teach the computer that the turtle can draw a box by repeating this sequence four times: go forward 50 steps, turn right 90 degrees. The Logo commands would be:

```
TO BOX
  REPEAT 4(FD 50 RT 90)
END
```

BOX is an example of Logo *procedure*. The first line (signaled by TO) specifies the name of the procedure. This procedure happens to be called "box" (since that's what it draws), but it could have been named anything. The rest of the procedure specifies the list of instructions to be carried out in response to the Box command. The word END indicates the end of the definition.

Once defined in this way, BOX becomes a part of the computer's vocabulary. Whenever you give the command BOX, the turtle will draw a box.

Color Logo Modes

Color Logo has four modes: *break, edit, doodle,* and *run*. Break mode is the central mode used for shifting to another mode. All modes return to the break mode when the red Break button is pressed.

All Logo statements and procedures are executed from the run mode. This is also where turtle graphics appear. Run mode can either run a procedure in memory, or act as an interactive mode. For example, if in the run mode the user types FORWARD 45, the turtle will execute that command as it is entered. The advantage of this interactive mode cannot be underestimated when working with children. Immediate visual feedback increases learning.

Edit mode lets the user create or change all the procedures in *the* workspace. (That's right, *the*. There's only

one, and if you want to save only a couple of the thirty or forty procedures you've written that day to tape, you will need to erase all the unwanted lines first.) In the edit mode, commands can be combined to form a procedure.

Doodle mode is entered from the run mode. A procedure name is typed and entered that becomes the name of the pattern about to be drawn. Doodle mode does not require a knowledge of letters, thus it is one that even very young children can successfully use. Color Logo comes with a keyboard overlay that identifies the keys necessary to this mode. (Note: the original Color Logo overlay does not fit the Color Computer 2 keyboard). When doodle mode is exited, the pattern just created can be redrawn in run mode by executing the name given to it earlier. Also, an orderly listing of the keys that were punched appears on screen during the edit mode. This is useful when working with beginners of any age, as it teaches how a computer processes information in a sequential manner.

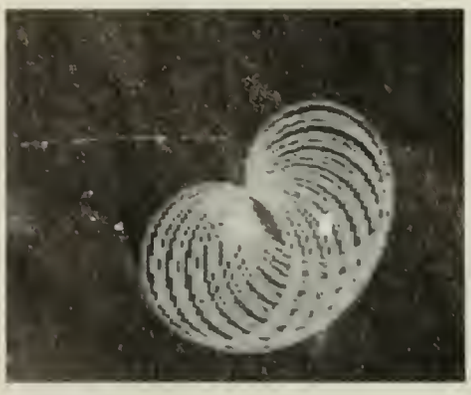
I try to limit doodle mode activity in my upper elementary classes. Though it is enjoyable and serves as a fine introduction to Logo and computers, less thinking is required in this mode.

Procedures and Subprocedures

The true power of Color Logo lies in its inherent ability to produce complicated graphics with minimal programming. This can be done by constructing a design in one procedure, then repeating the original procedure a certain number of times in a separate procedure. Sixth grader Billy McHenry did this in a favorite program which he entitled "Slinky."

First, Billy made a large circle in the edit mode.

```
TO CIRCLE
  REPEAT 24(FD 15 RT 15)
END
```



Slinky, by Billy McHenry

To have many circles close together to resemble a slinky, Billy repeated the circle 25 times. After each circle was completed, he had the turtle turn slightly (five degrees). For style purposes, Billy changed the colorset and made the background (BG) black. HT hid the turtle.

```
TO SLINKY
  COLORSET 1 BG 0 PC 2
  REPEAT 25(CIRCLE RT 5)
  HT
END
```

When you have written a procedure to do a task, you can use it in any other procedure you write without having to chain it or link to it. This leads to clearer, more structured programming and thinking in contrast to the development of one long, complicated procedure (program), which is common in other languages.

Color Logo can bring the essential element of surprise to learning. Despite the popular belief that a computer can never surprise its programmer, even very simple procedures can and often do produce unexpected and striking results. Encountering one of these results, studying it, and understanding how it comes about can be an open-ended adventure.

Fifth grader Matthew Perry was on a 45-degree-angle kick one day when he discovered he could make a three dimensional replica of a fan.

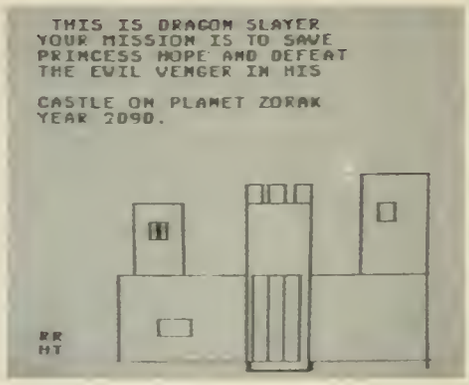
```
TO 45
  FD 45 RT 45
  FD 45 LT 45
  FD 45 RT 45
  FD 45 LT 45
  FD 45
END

TO FAN
  REPEAT 200(45)
END
```

Fourth grader Justin Deri worked hard on this three dimensional rectangle.

```
TO THREE

  REPEAT 4(FD 40 RT 90)
  RT 45 FD 40 RT 45 FD 40
  RT 135 FD 40
  PU
  RT 45 FD 40 RT 90 FD 40
  PD
  RT 45 FD 40 RT 45 FD 40
  RT 135 FD 40
  LT 45 FD 40
  LT 135 FD 40
  LT 45 FD 40
  RT 90 FD 40
  RT 90 FD 40 HT
END
```



One young programmer is writing an Adventure game in Logo. Here's a screen from "Dragon Slayer."

A variety of interesting designs can occur when Three is incorporated into another procedure. Try these:

```
TO HEX
  REPEAT 4 (THREE AT 90)
END
TO CIRCLE
  REPEAT 23 (THREE RT 85)
END
```

Matt Sucec began work one day determined to produce a star. When he was done he had learned that enough of his "stars" produced a "sun."

```
TO STAR
  FD 30 RT 120
  FD 30 LT 45
  FD 30
END

  TO SUN
  REPEAT 45(STAR)
END
```

Sven Bonnichsen, a true micro-explorer, discovered a handy way to have words gradually vanish from the Logo screen. He begins by changing the background to black ("to set the mood") and hiding the turtle.

```
TO VANISH
  BG 0 HT
```

Then Sven uses the Logo version of PRINT@. He has learned that the Logo coordinates start at (0, 0) at the bottom left hand screen. He moves the turtle 90 over on the X coordinate, and 10 up on the Y coordinate. Since the turtle will print words wherever it happens to be, Sven has the turtle print VANISH there.

```
SETX 90 SETY 10 PRINT"VANISH"
```

Then the turtle is moved to the far right side of the screen at the very bottom. He turns the turtle west.

```
SETX 255 SETY 0 LT 90
```

The turtle is then programmed to go back and forth ten times with the pen down to erase the word.

```
REPEAT 10(FD 255 RT 90 FD 1
RT 90 FD 255 LT 90 FD 1 LT 90)
```

Working with Logo is a series of *"Ah Ha!"* experiences for kids.

Top-Down Programming

Logo can be a magnificent introduction to the wonders of structured programming if children are encouraged to approach a graphics problem as a whole which can be broken down into subproblems. This is known as top-down programming. With upper elementary children, I usually begin working on this as early as their second week on computers.

A popular challenge is to put the turtle in jail. I give my students a drawing, such as the one on the title page (simplified, of course), that they must duplicate on screen by writing procedures in the edit mode. I impose limitations. The programmer must use at least three subprocedures for the first procedure, which is to be called "Jail." Thus, kids must work from the top down, breaking the larger problem into subproblems at the outset.

Sixth grader Beth Genco offers the following solution to "Jail."

```
TO JAIL
  WALLS
  BARS
  MIDDLE
END

TO WALLS
  FD 50 RT 90
  FD 90 RT 90
  FD 50 RT 90
  FD 90
END

TO BARS
  RT 180
  REPEAT 4(FD 10 LT 90 FD 50
  RT 90 FD 10 RT 90
  FD 50 LT 90)
END

TO MIDDLE
  PU
  LT 135 FD 48
  LT 135
END
```

"Walls" draws the outside boundaries, "Bars" draws the bars and "Middle" employs PENUP to put the turtle in the middle of the jail.

In our elementary school, Billy McHenry is a virtuoso at the Color Logo keyboard. His "Toys" program is a prime example of top-down programming.

```
TO TOYS
  BOUNCE
  REPEAT 1000()
  TRUCK
  REPEAT 1000()
  STARS&MOON
  PRINT "DON'T YOU LIKE MY TOYS"
  HT
END
```

The command REPEAT 1000() serves as a time delay between the display of his different toys. Billy hides the turtle at the end of the print statement so the turtle does not block the final letters. Here are the remaining procedures to "Toys":

```
TO CIRCLE
  HT REPEAT 24( FD 7 RT 15)
END

TO BALLD
  PU BK 10 PD CIRCLE
  HT END

TO BALLS2
  CLEAR HT CIRCLE
  REPEAT 50 (HT) CLEAR
  HT BALLD
  REPEAT 50 (HT)
END

TO BOUNCE
  REPEAT 5 (BALLS2)
  CLEAR HT
  PRINT "SEE MY BOUNCING BALL"
END

TO TRUCK
  CLEAR
  PRINT"TRUCK" HT PU
  LT 90 FD 50 LT 90
  FD 15 PD
  REPEAT 8(LT 45 FD 5)
  HOME HT PU RT 90 FD 50
  RT 90 FD 15 PD
  REPEAT 8(RT 45 FD 5)
  HOME HT PU
  RT 180 FD 5 RT 90
  PD FD 40 BK 90 RT 90
  FD 20 LT 90 FD 90
  LT 90 FD 10 RT 90
  FD 10 LT 90 FD 10
END

TO A
  REPEAT 4 (FD 20 RT 90)
END

TO B
  REPEAT 25 (A RT 15)
END

TO C
  REPEAT 3 (B RT 5) HOME
END

TO D
  PU RT 90 FD 60 LT 90
  PD B HOME
  PU FD 60 PD B
  HOME PU
  LT 90 FD 60 RT 90
  PD B HOME PU
  BK 60 PD B HOME
END

TO STARS&MOON
  CLEAR
  C
  D
  HT REPEAT 1000()
  CLEAR
  PRINT"STARS & MOON"
  REPEAT 1000 ( )
  SX 20
  END
```

Subdividing a long program makes debugging much easier. Successful debugging in turn builds confidence. Beginners develop healthy attitudes toward making errors. This attitude is essential in a discipline like computer programming, where you rarely get the program right the first time.

Advantages and Disadvantages

There are advantages and disadvantages to Radio Shack's version of the language when compared to other Logos. The first advantage is price. At $49.95 for the ROMpak cartridge, Radio Shack underprices all the other heavies. Apple Logo costs $175, Commodore's is $95, Digital has a package for $250, and Atari's markets for around $100.

Another advantage is workspace. The cartridge version does not occupy any memory space, allowing ample workspace. It should be mentioned that the disk version does require 32K.

In my mind, Radio Shack machines are superior to any micro when it comes to editing, and this is true with Color Logo as compared with other Logo systems. Logo is most often run on the Apple computer, but Apple editing is just plain archaic. Though I have not taught children Logo on the Apple, I have myself worked on both Apple Logo and Terrapin Logo. Editing on the Apple after using the Color Computer is a frustrating experience. Children rapidly grasp the fundamentals of editing in Color Logo.

Color Logo has a turtle graphics command that is unique. HATCH is the ability

Kids help one another...

...and concentrate intensely

to create multiple (up to 255) turtles that can send messages to each other. A new turtle is created with the Hatch command, and then given an identification number, a procedure name to begin executing, and an optional list of parameters to the procedure. The newly created turtle has the same shape, heading, and location as the turtle that created it. It exists until the procedure calling it finishes or until a VANISH statement is called with its number. Color Logo processes one statement from each turtle, then repeats the process. This gives the illusion that all the turtles are executing their programs simultaneously.

Another Color Logo feature that deserves mention is the ability to redefine the turtle's shape within a program. This can be used to change the turtle's usual form, or even to perform some limited animation, by rapidly redefining the turtle shape.

But, Color Logo is at a disadvantage in some respects.

Keep in mind that Logo was intended to be used by children. Color Logo supports the same turtle graphics that comprise other Logo systems (with the exception that other systems, except Texas Instruments, allow the use of a floating decimal point. This, indeed, is a major weakness which the authors are apparently working on). But Color Logo does not support any string- or list-manipulating words. Other Logo systems can alphabetize a word list or ask a series of questions with programmed answers. The absence of this list manipulation feature (which derives from Lisp) is the reason critics may claim Color Logo is "less powerful" than other Logos.

Some of the other Logo packages include a music option. Through commands such as BEAT and BOOM, students experiment in an environment that builds on their intuitive musical knowledge.

Color Logo clearly trails all systems when it comes to documentation. The first Color Logo manual is adequate. The competition is just simply impressive. The documentation for Terrapin Logo (produced by the M.I.T. group) should be a classic work in the field of education.

A small disadvantage, perhaps, is that Color Logo does not provide for comments (as in remark statements in Basic) as Terrapin Logo does. When I teach Basic I encourage remark statements every five lines. An option for comments would be nice.

Radio Shack will unquestionably attempt to upgrade their Logo package. Color Logo, with its faults, is an outstanding system for use at home and in elementary schools. Apple and Terrapin Logo offer more depth, and are receiving much more use at the Junior High and High School levels.

Diagnostic Tool

I cannot begin to express how much I have learned about how my elementary students think and solve problems by watching them interact with Color Logo. Their thought processes become very visible through their work. Each day I seem to learn more about individual learners, and how much I can expect from them.

Teachers of the handicapped experience similar revelations. Susan Jo Russell, who works with severly handicapped children at the Cotting School outside Boston, relates: "Many kids with problems cannot or will not reveal how they think. Logo becomes a medium of expression. It can be used as an assessment for how much learning we can realistically expect from a particular handicapped child."

Special educators have also noted improvement in self-confidence and motor control in their students who have worked with Logo.

The Future

Color Logo is playful, but not frivolous. The brand of mathematics that is explored in it is, in actuality, finite differential geometry, normally considered an advanced topic in a university curriculum. Yet the exploratory approach brings it within reach of even very young children.

This brings us to an even larger question: What effect will Logo have on the world of computer languages? All systems seem to be headed in the same direction — making very complex programs easy to use. A common goal for the future is to integrate computers directly into people's lives and make them accessible to all. As programming languages become more and more accessible, lots of people are going to learn to program.

As micros become more powerful, imagination and program design (Logo staples) become more important than the ability to write efficient code. Memory is cheap. The once-valued programming wizard who could compose a program that conserved memory will take a back seat to the creative programmer.

Graphics will be available to a wider and wider group of programmers. If you can describe what a program does, you will be able to write a program. Logo is the initial step. Undoubtedly, millions of twenty-first century programmers will trace their programming roots to a delightful cursor called "the turtle." ■ ■ ■

FOR MORE INFORMATION ON THIS INTRIGUING SUBJECT...

LOGO ASSOCIATIONS:

Logophile *— published by the College of Education, Queen's University, Kingston, Ontario K7I 3N6*

National Logo Exchange *— published by Posy Publications, P.O. Box 5341, Charlottesville, VA 22905*

Polyspiral *— by the Boston Computer Society, Three Center Plaza, Boston, MA 02108*

The Logo and Educational Computing Journal *— by Interactive Education Foundation, 1320 Stony Brook Road, Stony Brook, NY 11790*

Turtle News *— by The Young People's Logo Association, 1209 Hillsdale Drive, Richardson, TX 75081*

FOLLK, Friends of Lisp/Logo and Kids *— 245 Lagunda Honda Blvd., San Francisco, CA 94116*

Even kindergarten students learn from, and enjoy, using Logo.

I have a 32K TRS-80 Color Computer which I want to upgrade to 64K. A Radio Shack serviceman told me my machine was a new model and already had the required chips. All that is needed is to change a few wires, for $15, which he did. After the modification I was told I would need $570 worth of add-ons to use the additional memory: a disk drive, OS/9 Operating System, and Basic-09 (I currently have only a cassette-based system).

Do you have any articles explaining how to use my additional memory without having to buy the extra hardware/software?

— R.A., Pomona, CA

The Color Computer memory map is divided into two sections, the lower 32K RAM bank and the upper 32K bank, which itself is divided into 8K of Basic ROM, 8K of Extended Basic ROM, and 16K reserved for ROMpak cartridges. Thus, even though you have 64K chips in place ready to use all 64K, the upper 32K RAM bank in your chips is preempted by the SAM chip reserving those addresses for ROM.

This does not mean you can't use the upper 32K RAM bank in your chips, just that you can't use both the upper RAM bank and the ROM chips without a "supervisor" assembly language program to switch between the two. You could use the upper 32K bank for data storage, with the remaining 32K for your program and graphics. "Hid 'n Ram" from Federal Hill Software (825 William St., Baltimore, MD, 21230, $24.95 tape, $27.95 disk) does this. Another choice is "64K Boot/Pager" from Skyline Marketing Corp. (4510 W. Irving Park Rd., Chicago, IL, 60641, 312-286-0762, $19.95 tape) which lets you manually copy data from one bank to another. Skyline also sells "Page Plus" which provides the "supervisor" needed to run programs larger then 32K in a 64K system. If sells for $27.95 tape, $29.95 disk.

Oregon Color Computer Systems (P.O. Box 11468, Eugene, OR, 97440) sells "MEM-OS64" (tape, $15.95). This lets you store programs in the upper 32K bank; you retrieve them as you need them, a small "RAMdisk" in operation. Check the ad pages for other programs.

You could also transfer Basic and Extended Basic from ROM to the upper 32K RAM bank, giving you an all-RAM system with the capability of running Basic programs as does Skyline's program, "64K Boot/Pager." Spectrum Projects (93-15 86th Drive, Woodhaven, NY, 11421, (212)441-2807) sells "40K" ($9.95), a program that also gives you 40K of RAM. Again, be sure to check the ad pages for other possibilities.

Unfortunately, we haven't yet published any articles on this subject.

Recently I switched four jumpers under the RF shield of my 32K Color Computer: one between U4 and U8, and three below U29 and to the left of U11. I was trying to temporarily downgrade the system to 16K. When I turned the computer on, nothing worked: I got only static on the screen. I immediately disconnected power and restored the jumpers to their original positions.

My problem is that now the computer just prints rows of at signs (@) on the screen. Can you tell me if I blew up the 6809 or one of the ROM chips? Where can I get replacements? I have board number 8709137-E.

— T.R., San Luis Obispo, CA

I'm sorry to say that you've blown all your RAM chips. The 64K RAM chips use only one +5 volt power line. The 16K RAM chips use +5 volts, +12 volts, and −5 volts. By moving the jumpers you applied +12 volts and −5 volts to the 64K chips.

Your only choice is to buy a new set of eight chips. Fortunately, there are many companies selling these with prices ranging from $49.95 to $99.95, or you can have Radio Shack install their RAM chips for $149 plus $15 labor charge.

Where can I find a book that describes the Color Computer operation and organization so that a beginner can understand it? I don't mean one about programming, but one that will help me understand technical articles.

How do disk drives compare? Why should, or why shouldn't, I buy Radio Shack drives, Amdisk drives, or any of the others available? Why is the Commodore 64K disk drive only $200, when the Radio Shack drive is $400? How do disk systems (OS/9, Flex, and Radio Shack Basic) differ? Why is Flex such a big deal? How is Radio Shack Disk Basic different from Extended Basic? What are tokens and how do they work? Why should I buy a program on disk when it's cheaper on cassette? Can't I just transfer the program to disk?

If I use a non-Radio Shack 64K modification will there be any differences? And will there be any differences which affect program operations? Which ones are the best modifications?

Why is the Color Computer screen size so small? Can I permanently enlarge it? And why doesn't it have a non-destructive, fully moveable cursor, such as is on the Commodore-64?

How does Radio Shack Basic differ from other Basics? What is CBASIC? How can I take a book of generic Basic programs and use them in my Color Computer?

What is a buffer?

I own a cassette-based 16K Color Computer with Extended Basic 1.0. Thanks for your help.

— R.M., San Diego, CA

A good technical book for beginners is *Color Computer Secrets Revealed* ($14.95). A more advanced manual is the *Radio Shack Color Computer Technical Manual* from National Parts (900 East Northside Dr., Fort Worth, TX, 76192, 817-870-5662). Make sure you also order the supplemental section for your computer's revision letter. Open the case

(which voids your warranty) to see what letter follows your board's serial number (between the keyboard and the expansion ROMpak port).

Radio Shack disk drives use 5 1/4 inch disks, with 35 tracks per disk, 18 sectors per track, 256 bytes per sector. Amdek drives are much smaller physically, but give the same data storage parameters. The advantage of other drives is in the disk controller ROMpak. The Radio Shack Disk Controller ROMpak uses the 35-track, 18-sector parameters for data storage. Disk drives with higher data storage capabilities such as 40- or 80-tracks, or double-sided operation, are limited to the parameters set by the Radio Shack controller when used with the Radio Shack ROMpak.

The disadvantage is that since the Radio Shack controller also contains the Disk Basic ROM, these other controllers can't give you Radio Shack Disk Basic (copyright laws and licensing arrangements with Microsoft and Tandy are behind that problem). As a result, not all programs written for the Radio Shack disk system will work with these non-Tandy disk controllers, but all programs written using Extended Basic commands will work.

Commodore drives are cheaper because the chips are manufactured in Taiwan, where labor is cheaper. Also, the Commodore drives use serial data transfer, one bit at a time, rather than the faster parallel method used in Radio Shack drives.

The main difference between Tandy and non-Tandy disk operating systems is that Radio Shack Disk Basic enhances the ROM Basic in your Color Computer while the non-Tandy systems don't use the ROM Basic at all, and they require that you have a 64K Color Computer. With the Radio Shack system, you run the disk drives through Basic. With the other systems, Basic isn't used until you load it. This also has the consequence that programs written in Radio Shack Basic can't be used with these other systems unless you also buy their versions of Basic. In other words, Flex and OS/9 put you in the Disk Operating System until you load Basic. Transferring programs from Tandy Basic to these other Basics is a chore, although most dealers include a utility that will help you do this.

Flex is a big deal because it has been available for 6800 and 6809 computers for over four years. Because it has been around so long, there are many programs available for it.

Disk Basic includes the additional commands needed to store and retrieve data and programs to and from the disk drives.

A token is a one- or two-byte code stored in place of a word when programming. Use of tokens helps squeeze large programs into small spaces. For example, the Basic command INPUT has a one-byte token. Each time this token is used four bytes of RAM are saved.

Programs sold on disk are generally adapted to use disk drives for data storage, while the cassette programs assume cassette data storage. Some programs, primarily assembly language games, are the same for both disk and cassette versions; however, because Disk Basic is interlaced with Extended Basic, many assembly language cassette-based graphic games won't work with the disk ROMpak. So while you could store the cassette program on disk, you wouldn't be able to load and play the game. If the program is written entirely in Basic (no POKEs or assembly language modules), then you can buy the cassette and use disk drives without problems, as long as you have enough room in RAM. Disk Basic reduces the amount of free RAM by almost 1536 bytes. So, short Basic cassette programs can easily be used with disk drives, but big Basic programs might have problems, assembly language programs might clash with the Disk Basic ROM and crash the system, and many assembly language graphic games will definitely crash the system.

The Radio Shack 64K modification, for all revision E and previous boards, is simply replacing the old board with a new revision NC (or F) board, with 1.1 Extended Basic included in the swap.

For a while, Radio Shack upgraded the various boards to 64K via cutting circuit board traces, removing capacitors, and adding jumpers. For instructions on how to do this using Radio Shack techniques see the October 1983 issue of **The Color Computer Magazine** and read Dennis Kitsz's Custom Color. Also be sure to check the Fix in the January 1984 issue before doing the upgrade. Using Radio Shack methods, programs will be completely unaffected by the particular revision board in your computer. As far as the program is concerned, you have the latest version board.

The Color Computer screen size of 32 columns by 16 lines was selected for one major reason: in order for the Color Computer to have the widest market possible, it had to work with *all* the color TVs currently on the market, including those made in the 1960's. The older televisions are much more rigid in what input they will accept, so a limit was set on the number of characters per line. More than 32 characters on an old TV set are unreadable. Radio Shack opted for the larger letters and smaller character count.

There are programs to provide more characters per line and more lines per page, but most require a high quality TV or video monitor to be readable. They redesign the characters with fewer dots; thus, 64 characters per line leaves only three dots available per character. The disadvantage is that you must load one of these programs every time you want the higher character count.

There is a permanent hardware fix, but it's expensive: ColorMate, from Computer System Distributors (P.O. Box 9769, Anaheim, CA, 92802, (714)772-1390) is a hardware box you plug into your ROMpak port. This modifies the Color Computer to use 42-character lines, with 24 lines per screen. It provides true uppercase/lowercase characters (not reverse video lowercase) and keyboard type-ahead. It also provides another ROMpak port to replace the one it is using, so you can still plug in your ROMpaks while the ColorMate is attached to your computer. The ColorMate sells for $495 (check ads to discover whether other options are currently available).

Microsoft and Tandy apparently felt that the additional room required in ROM to implement a non-destructive cursor wasn't worth leaving out one of the other features included in the Color Computer.

The granddaddy of Basic is Dartmouth Basic, originally designed to give beginners a simple, yet powerful, programming language. Currently there are dozens of versions of Basic on the market. CBASIC is a popular and powerful version. Tandy sells a book: *BASIC Conversion Handbook* (62-2088, $5.95) for converting Apple and Pet programs to Model I and III Basic. In most cases the I and III commands will work with the Color Computer. A more complete guide to Basic and all its dialects is *The BASIC Handbook, 2nd Edition* by David Lien ($19.95).

A buffer is a block of memory set aside for a program's temporary storage of data received from, or to be sent to, an external device. Buffers give programs a simple way to communicate (input or output) without needing to be in-step with the other end of the link. A disk drive sends an entire sector of data (256 bytes) all together, even though a program may only need a few bytes at that moment. Sending data to a printer buffer instead of directly to the printer means a program can get ahead of the actual printing, and be able to process other data sooner.

Whew, hope that helps! ■■■

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☎ Enter 51 on TeleResponse page 134

Basic09

Radio Shack
One Tandy Center
Fort Worth, TX 76102
(817)390-3885
64K, disk drive, OS/9
Disk Extended Basic
$99.95

RADIO SHACK'S BASIC09 STANDS a chance of becoming the most popular programming language and application package for OS/9. It is a major software package and programming environment. People who want to write business and other "serious" programs that run fast, intermediate-level programmers currently working in Basic, and people who want to step up from Basic and learn a modern, structured language — but who don't want to learn Pascal from scratch — will be interested in Basic 09.

Computerists who may *not* be ready for Basic09 are less than proficient with Extended Disk Basic, and programmers who want easy color graphics, pictures, or games with sound and full color objects. For programmers who want to produce assembly language programs, and for Color Computer owners who want to use the easiest-to-edit, friendliest language but who aren't particularly interested in the speed of a compiled language, Extended Basic still remains the best choice.

A brief history of Basic09 is given in its reference manual. Motorola, the makers of the Color Computer's microprocessor, the 6809 chip, commissioned its creation to put to work all the power of that chip and to produce an efficient, high-level, interactive, compiled language. Almost all Basic languages are interactive, but not compiled. *Interactive* means a program gives immediate feedback to its programmer during the writing and debugging stages, with easy-to-follow error messages for each statement as it's encountered during the editing or the execution stages.

Interactive Basic has been crucial to the popularity of personal computers from the beginning. Most versions of Basic are *interpreted:* they let new programmers write a program one section at a time, run it and see it operate, executing each line until a bug is spied, identified, and fixed. This process repeats until the program runs error-free, which is important to beginner programmers since it encourages the learning process. But constant error checking (interpreting) slows a program down. For instance, each time the program is run syntax error checks look to see if you have pressed the Break key, and other operations are done before each line is executed, even if they've already been debugged. That's nice and polite — but too slow for intermediate and advanced programmers.

"Interactive Basic has been crucial to micro's popularity..."

In *compiled* languages like Fortran and some versions of Pascal, a source program file has to be completely written in a high level language. Then it's processed (compiled) by a program that converts the whole thing into machine code (object code). The code, when executed, runs very quickly. Usually most newly written source programs have bugs in them, and when they are compiled error messages are given, but the exact location of the bug is not easily identified since the compiled code is not exactly related to each line in the source file. So compiled programs are harder to write and more frustrating to debug.

Very few Basic languages are compiled. Basic09 is an exception, but was designed to be easier to debug than most other compiled languages. How? It checks for syntax and other errors as soon as each line is typed and the Enter key is hit, just like Atari and some other versions of Basic. This checking occurs during input under the edit mode of Basic09. When the program is run it is compiled and runs until a line with any other type of error is encountered. Then Basic09 automatically switches into debugging mode and identifies the source program line where the error exists.

In Basic09 you can also enter Pause statements that can be used with the debug mode to let you examine the current values of any variables of your program during the pause. A Trace command will activate the printing of the computed result of each line of code as it is executed to help debug the program.

Basic09 is a *structured* language, like Pascal and Logo, and *unlike* Color Basic. Structured computer languages are the most popular type of languages in the engineering and science communities. A structured language does not allow writers to create lots of GOTO branches that cut program flow into an unintelligible helter skelter. Long jumps make it hard for even a program's author to follow the logical flow of program operation. (Some structured programming commands in Basic09 are ENDIF, While..Do, ENDIF, Endloop, and Repeat.) Also, in a structured language, "procedures" are used. These are simply subroutines or short programs that are named and stashed at the end of the main program. They are called or executed from the main program, and data (values) can be passed to them as "arguments."

An example of one procedure that *is* in Extended Color Basic is the Circle function. You simply call that function and give the center, radius, and color, and do not worry about writing more code to get the job done. In addition, you can easily understand a line containing `CIRCLE(X,Y),Z` instead of `GOTO 10000`, which would make you lose your place when trying to read and understand the program. In Basic09 you can write your own procedures and store them on disk. You may also use GOTO statements when you must. When running a new program the procedures are loaded into memory as the main program calls them for the first time. There they remain for later use. To eliminate the disk loading time delay, procedures can be loaded into memory before running the program that calls them.

Other Features

Basic09 has other technical advantages over Extended Color Basic, including five data types; Byte, Integer (two byte), Real (or five byte floating point), String, and Boolean. The ability to define a variable or data as an integer saves four bytes each time it's used. It also speeds up whole number calculations because the 6809 can operate with integers in microseconds, while special subroutines are needed for floating point arithmetic (required in Color Basic) that take hundreds of times longer to run. Another feature: a single data structure mixing different data types can be created so string data (name), integer data (age), and real data (salary) can be mixed and stored on disk as a single record for random access file handling.

An On Error GOTO command is provided; Color Basic has no such thing.

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—COLOR COMPUTER NEWS JAN '83

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With this command you can avoid losing your data when a Basic program crashes due to operator or disk I/O errors. This has happened to me many times when I use certain Disk Extended Color Basic "filing" programs. If I get an I/O error from a bad disk from which I'm trying to read data, all the entries I have just typed in are lost. With Basic09 I simply put an On Error GOTO statement before a disk I/O call, or in other spots where errors are likely to occur. Then the program will go to a routine designed to handle the program after the error is encountered.

The Date command calls in the year, day, hour, minute, and second from OS/9's real-time clock. And a useful mode in Basic09 that is not in Extended Color Basic is the degrees (as well as radian) declaration.

Speed

To test the speed of a language, or of a computer, a benchmark program is run. *Benchmark* programs are sets of calculations, function calls, and other operations. A very thorough benchmark program was written for testing many personal computers using their own versions of Basic. This 30-second program was run on the Color Computer along with the Apple II, Atari 800, Commodore 64, IBM PC and other machines. The program and results were published in an article called *Benchmarking The Color Computer* in the March, 1983 *Color Computer News*. In that test the Color Computer, with its Extended Microsoft Basic, executed the required calculation 87 times, versus the Apple's 114 and the IBM's 170. Also, Basic09 was run on the Smoke Signal Chieftain computer with a 6809 microprocessor running at 2 MHz. It executed the calculation 500 times. The article points out that by typing POKE 65495,0 many Color Computers can be made to run at a faster effective clock speed. When I ran the benchmark program on the Color Computer using Basic09 I got a result of 230, less than half as fast as the Smoke Signal Chieftan computer running Basic09, because the Color Computer runs at 0.9 MHz. (The integer mode was used wherever possible for maximum speed.)

I was disappointed with the speed of compiled Basic09 compared to interpreted Extended Basic. I think the benchmark program runs so quickly in Extended Color Basic because the floating point math calls are efficient assembly language subroutines. This is also true of hires graphics like the Circle command. To test the graphics speed, I ran a simple animation program in Basic09 and Extended Color Basic. Basic09 did not move a small circle across the screen much faster than Extended Basic.

The Dark Side

The high resolution Graphics command in Basic09 are limited to Point, Line, and Circle, and to clearing the screen with different colors. No Paint command exists, so all graphics must be lines only and can not be filled in. No text can be written on the graphics screen, and no sound commands are provided in Basic09 (or in OS/9). Hopefully users will publish some assembly language programs that can be called from Basic to provide such features from a procedure call.

My opinion of the ease of use of Basic09 must, of course, include some thoughts on the OS/9 operating system. Fundamentals of the OS/9 operating system must be mastered before you can use Basic09. OS/9 is described as user friendly in Radio Shack documentation. As a new OS/9 user with one disk drive, I found that to be untrue. I am used to Color

☎ Enter 21 on TeleResponse page 134

Basic, where you can read a few pages of the manual, type a few lines, run a program, revise it, and look up only what is necessary to debug and add new features.

Getting a directory and saving files is easy in Disk Color Basic. With OS/9 I found myself getting a lot of error messages when typing simple load and directory calls. I was even unable to use Basic09 when I followed the instructions in the Basic09 manual. To load and execute Basic09, it said to type BASIC09 at the OS/9 prompt. I got an error message. After consulting a more experienced OS/9 user, I found you first must type CHX/D0 to change the execution directory to let the system load and run the program disk in drive 0.

Another way to start up is to type LOAD LOAD. This lets you load files with the OS/9 system disk removed. Then you can put the Basic09 disk in drive 0, type LOAD BASIC09, and type BASIC09 at the OS/9 prompt. For two-drive owners, put the OS/9 disk in drive 0, the Basic09 disk in drive 1 and type CHX /D1. Then type BASIC09 after the prompt. I encountered similar problems when exiting BASIC09 to look at the directory of saved files on the disk, and to look at other statistics of the system. These are problems in OS/9, not in Basic09, and should be limited to your first few sessions on the OS/9 system.

Basic09 itself is easier to handle than OS/9. Very few system calls are required. The editor is a string and line editor, while Color Basic has just a line editor. The Basic09 editor is a shortened version of the more powerful OS/9 editors. The OS/9 editor reminds me of the editors on big, $100,000 minicomputers and mainframes. After positioning the "invisible cursor" (line pointer) at the beginning of a file, simply type in S/XYZ/ to find the line that contains XYZ. You don't need to know the line number, or even to *have* line numbers. You can also advance to a line you want to edit by hitting the Enter key to step down one line at a time, or type +N or −N to advance down or up N lines. Finally, you can type L to list the next 16 lines (auto scroll) and hit Enter to scroll down another 16 lines.

A bug exists in the scroll procedure though, since lines with more than 32 characters wrap around. This causes certain lines to scroll by before you can inspect them, forcing you to resort to scroll freeze key strokes. In Color Basic, after you type LIST you have to perform the hit-the-Enter-key-and-quickly-hit-the-@-key-while-holding-down-the-shift-key. trick to avoid having the whole list scroll by. With OS/9 you can have even more fun. You must type L, hit the Enter key, then hit the W key while holding the Clear key down. Neither of these screen scroll freeze procedures are very good.

The reference manual is done in the professional programmer style: no pictures of smiling TV sets and no little stories. There is room for improvement. No exercises to explain short programs exist. Sample programs are given at the end, but they don't show you anything about their operation or flow.

Despite its problems, Basic09 is a bargain compared to competing software.

— Howard Bassen

Super Screen

Mark Data Products
24001 Alicia Parkway, No. 207
Mission Viejo, CA 92691
(714)768-1551
$29.95 cassette, $32.95 disk
Extended Basic required

ONE OF MY FRIENDS' favorite digs at my Color Computer used to be directed at its display. "What kind of pro-

Enter 76 on TeleResponse page 134

gramming can you do with sixteen 32-character lines?" they would sneer. "To do anything serious you need an 80 by 24 display."

Most of my friends own Apples, and only good manners have kept me from pointing out that they had to spend $100 to $200 on a hardware modification to their machines to get this 80 by 24 display. Now I have the last laugh. I have Super Screen.

Super Screen is a machine language program that gives you a 51-character by 24-line display with upper- and lowercase and reverse video. All the keys repeat when held down, and various control codes make professional displays easy. Basic's PRINT @ statement has been modified to work on the big screen. And there's also available the ON ERROR GOTO statement, with its associates, ERL and ERR.

The new display is very readable; I have a small (nine-inch) TV and never have to strain my eyes to read the display. Super Screen characters are legible but do not have descenders.

As far as speed goes, I ran a few tests and found that in programs that require almost no printing there is no real drop in speed. A program with an average amount of printing appears on the screen about one-third slower than usual, which to me is not an unbearable drop in speed.

Super Screen's set of control characters gives you a choice of cursor type (blinking or constant, block or underline), and display (inverse or regular). They also let you erase to the end of a line or to the end of the screen from the current cursor position.

The ON ERROR GOTO statement is something that at first glance looks a little silly, but with it you can get much more professional programs. Now you can trap errors that would normally stop your program cold. When an error occurs, you can make sure the program does not lose any data because somehow the proper disk wasn't inserted. When people are just starting to learn how to use computers, the last thing they need to see is an IO ERROR on the screen.

"...they sneer no more..."

The two functions ERL and ERR return the program line that contains the error and the number of the error encountered. The names of the errors associated with the numbers returned are in a table included in the documentation.

ON ERROR GOTO works as advertised, but there is one omission in its documentation. When Basic encounters an error, Super Screen resets the stack. This means that if you have an error in the middle of a For/Next loop, after handling the error returning to the loop will get you a Next without For error. The computer keeps track of these loops by using a stack, so if that stack is reset, it forgets about the FOR, and when it encounters a NEXT it doesn't know what to do. This problem can be averted, except that it's not documented.

Mark Data felt it was too confusing for the average programmer, but I think something this important should be covered in the manual. Aside from that, though, the documentation is good. It consists of four typeset pages that are well-written and cover the program's features adequately.

Super Screen is a worthy addition to anyone's software library. It has become my most-used utility, and has made programming in Basic on the Color Computer a joy rather than a chore. And with the money I've saved, I think I'll buy a, hmm, let's see...

— Gary Teter

Home Money Manager

Computerware
Box 668
Encinitas, CA 92024
(619)436-3512
$19.95 cassette, $29.95 disk
32K

WHEN I FIRST SAW Computerware's Home Money Manager program I thought I'd found something to help organize my complete home budget. I envisioned a scaled down version of a planned economy, a farewell to de facto financial planning. Well, it turns out that this program is a checkbook manager, no more and no less, albeit a checkbook manager with some nifty features.

The program is written in Basic and is menu driven with single key commands. However, the commands are number commands, not letter commands. It would be easier to return to the main menu, for instance, by hitting M rather than having to remember to press 4 to return from storage control or 5 from the reports menu.

With very good error trapping features, the program lets you break your expenses down into 26 categories, named according to your needs. A report can be printed to show the total of all funds charged against any account, so you can see how much was spent on books, on entertainment, on clothes, on miscellaneous items, and so on.

Three more reports are available. One lists all deposits made into an account, another prints out expenses, and the third gives a chronological listing of all transactions. All these can be limited to any period of time specified by the user.

You can view records, change them, and delete them, but unless you're going to modify this program, you'll have to get used to seeing dates, such as the seventh of January, 1983, displayed and printed as 830107, not 010783.

Overall, the Home Money Manager is a dependable checking account program. I did, however, encounter two bugs in the review copy. Printing reports would always print last month's report, not the reporting period requested. And when I hit D to delete a record, an ARE YOU SURE? Y/N message showed up, and it was impossible to return to the menu by pressing the N key. So I sent the disk to Computerware and 10 days later received a corrected program.

— Rafi Rahamim

How To Do It On The TRS-80

by William Barden, Jr.
Published by IJG Inc.
1953 West 11th St.
Upland, CA 91786
Phone: (714)946-5805
$29.95, paperback

I'VE FOUND A COMPUTER book with everything in it, including the kitchen sink. If you don't believe me, get hold of one and look at figure SDFB-3 — the kitchen sink sequential file. *How To Do It On The TRS-80* is an encyclopedic compilation of hints, fixes and operating procedures for the TRS-80 Models I, II, III, 100 and Color Computer. It has to be one of the easiest to use books ever published for TRS-80 users.

The book runs over 360 pages but there are no page numbers and no table of contents. This 8½ by 11-inch book begins, after a brief preface, with an alphabetical index that runs over 32 pages and lists almost 1800 entries. The index uses four-character mnemonic "keywords" instead of page numbers to specify sub-

REVIEW$

ject locations within the book. The index is followed by a six page "List of Procedures by Keyword," with almost 300 keywords in alphabetical order.

Mr. Barden's most well-known writings have been about assembly language, in which mnemonics (abbreviated notations) are commonly used. So it is not surprising that he's assigned a four-character mnemonic to each of the hundreds of topics in this book. For example, "disks, using flip side" is called DUFS in the index, and is found in the book right after DT1U ("Debug, TRSDOS/LDOS, Model I/III, Using"). To make the mnemonics easy to find, the outer edge of each page shows a letter of the alphabet in a large box, and each right-hand page has the mnemonic topics of both the left and right-hand pages in large, bold type.

Even for someone who has had several years experience PEEKing and POKEing around TRS-80s, it's hard to glance through this book without finding something new. For you beginners it is a goldmine: just look in this book and you'll probably find what you need, including explanations of Basic commands, statements and functions. Hardware, software, cassettes and disks are all covered.

The amount of detail the author goes into is staggering, as if he squirreled away notes about everything he's ever done with these machines, then organized them into a book. Dozens of charts, tables, drawings and simple schematics illustrate the subject matter. Additional subjects covered include cassette and disk operating systems. (The last 80 pages are devoted to the Model 100. The MC-10 Micro-Color Computer, Pocket Computers and the Model 4 or 4P are not included.)

The book is not meant to be read from beginning to end, but I found myself doing that anyway, discovering nuggets of information completely new to me and clearing up dozens of things that had eluded my understanding.

As a reference book, *How To Do It On The TRS-80* has the potential to save you many times its cost in the time, effort and frustration involved in unravelling some of the mysteries that abound in computers. For someone other than William Barden, Jr., with over 18 books on microcomputers to his credit to date, this would almost be a life's work. *How To Do It* is a massive testimonial to his capacity for detail and organization — and to his years of experience using TRS-80 computers.

— Fred Blechman

Hi-Resolution Screen Utility

CerComp
5566 Ricochet Avenue
Las Vegas, NV 89110
(702)452-0632
16K, cassette
$19.95

ARE YOU TIRED of having only 32 characters per line and 16 lines on your screen when writing programs? If so, you may want to try the Hi-Resolution Screen from CerComp.

After you CLOADM and EXEC, your screen has 51 characters by 24 lines, black letters on buff. The number of characters per line can be 64, 42, 36, 32, or 28. The letters remain the same size, only the number of dot spaces between characters changes. You can also have 85, 128 and 255 characters, but those modes are unreadable.

I entered a short graphic program and it ran perfectly in the correct colors. I saved it, turned the computer off and back on, and entered the program. It again worked as expected. When I Listed it, the screen was in the usual 32 by 16 format. If you are creating text to be displayed in your own programs, you will have to remember this so that your words will not be divided incorrectly.

CerComp gives you four pages of documentation and a listing of a program to demonstrate the capabilities of Hi-Resolution Screen. This documentation could be better. It doesn't tell you to enter PRINT CHR$(8) and PRINT CHR$(17) when you first get your OK prompt. Those codes allow your left arrow to move the cursor back on your text and to erase a character, as you can on a regular screen. It also doesn't tell you that by pressing the Shift and zero keys your keyboard goes into the typewriter mode. Also, use only capitals for your Basic commands — they won't work otherwise.

— Thomas Taulli

(A new version of this product is the Hi-Resolution II Screen Commander, available for $24.95 on cassette, $29.95 on disk. Besides a rewritten manual, it has an adjustable auto-key repeat, switchable background color, two character set control codes, and more. — Ed.)

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Ockywoky

We are proud to announce that we are now the exclusive publishers of this great game from Shooting Star Software. Lovers of SPY THRILLERS take note. In Ockywoky the object is to find out the name of the double agent (code named Ockywoky) who operates on behalf of the evil Dr. Glimm. Ockywoky is to be found in one of 16 bureaus worldwide, and the field of suspects has been narrowed to 32. You can discover the identity by interviewing informants or by finding Dr. Glimm's headquarters and the combination to his safe. While you have a private jet at your disposal, your money and time are both limited. There are four difficulty levels, and the game is different each time you play. Average playing time is 45 minutes. This game uses a combination of text and hi-resolution graphics, and naturally it requires 32K of memory with Extended BASIC. If you've been disappointed by other so called mystery games, this is for you. Sherlock Holmes would have been proud of this one! **Tape (disk compatable) - $24.95; Disk - $29.95**

Baseball

Most sports computer games require no more knowledge of sports than Pac-man, but this one is different. This is a strategy version of the game, and you can play against another player or the computer. You decide on the pitch, whether to swing, steal, etc. This game plays just like the real thing, and a good knowledge of baseball will be needed if you plan to beat the computer, so if you're tired of arcade games and want a more mental challenge, this baseball is for you. Needs 32K Extended BASIC **Tape - $24.95; Disk - $29.95**

Dealer and author inquiries are always welcome. Canadian dealers should contact Kelly Software Distributors, Ltd., P. O. Box 11932, Edmonton, Alberta T5J-3L1 (403) 421-8003

Super Scroll

This brand new utility from the author of Colorkit gives 64K owners all the most wanted features. With this program in the computer, everything that scrolls off the top of the screen is stored in the upper (unused) 32K of RAM. When you want to look at it again, you can scroll up and down through this buffer using your joystick. For example, if you list a long BASIC program, most of it will scroll right off the screen, and now you can browse up and down through your longest listing. In addition, you will have the advantage of a FULL SCREEN EDITOR, a GLOBAL SEARCH, and even a definable key. If you program, you will save hours of debugging time, so quit letting your valuable text scroll into oblivion. Call it back with SUPER SCROLL. Works on 64K RAM tape or disk systems. **$24.95**

Modem Master

This program is designed for use with the Hayes Smartmodem or Novation Smartcat, and for you owners of these advanced modems the Modem Master will finally let you use all of those neat features you see described in the manual. Auto-dial, storing your list of bulletin board numbers for automatic calling, and a lot more. If you spent the money for a top modem, it's time you got to use all the top features. Modem Master is compatible with most all popular terminal programs, and requires a disk drive and at least 16K RAM. **$24.95**

Light Runner

An extremely challenging ARCADE ACTION game! You control the direction of the moving dot that draws a line of light, while the computer controls the direction of up to three others. If you run into your own light line, any of the computer's lines, or the edge of the screen, it's death, and you can't stop to think. Your fire button will speed you up, but you must keep running and running, with instant oblivion just a slight miscalculation away. Yes, this game requires superb reflexes and lightning responses, but in addition you will have to be planning your strategy — while you dodge destruction. Are you up to the challenge of the Light Runner? 100% machine language and all Hi-Resolution graphics. Don't miss it! **Tape - $24.95; Disk - $29.95**

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NEW:PRODUCT$

Sea Quest

Mark Data Products
24001 Alicia Parkway #207
Mission Viejo, CA 92691
(714)768-1551

Treasures under the sea are the prize in this adventure game and, as one might expect, the sea's dangers provide the spice. Pirates, hungry sharks, and mermaids are all part of the action. The 32K game costs $24.95 on tape, $27.95 on disk.

Ultrapaint

Spectacular Software
Box 363
Mansfield Center, CT 06250

Ultrapaint is designed exclusively for use with PMODE 4 graphics. It lets you "paint" virtually any shape created with Basic's Line, Circle and Draw commands with any of several hundred colors. The colors may be previewed on the screen. Ultrapaint operates at about 150 times the speed of the Paint command. It costs $9.95.

C.C.A.D. Converter

Technical Hardware Inc.
Box 3609
Fullerton, CA 92634
(714)870-1882

Turn your Color Computer into a data acquisition system with this 12 bit analog to digital converter card. The card lets you digitize 16 bipolar (plus/minus 4.095 volts) inputs with plus/minus one millivolt resolution. A board plugs into your cartridge port and the analog input connects to the C.C.A.D. card with a 44-pin card edge connector. A cassette containing a menu driven operating system is included. The program lets you set active channels, set time to acquire data via an internal real-time clock, save data to tape, turn on and off three alarm signals, print data, and display data on the screen. The interface and software package costs $169.50.

National CBBS Directory

Thomas Wnorowski
3352 Chelsea Circle
Ann Arbor, MI 48104

Over 1000 computer bulletin board service (CBBS) telephone numbers listed in numeric sequence comprise the bulk of the National CBBS Directory. Also included is a key field that lists each BBS's type, baud, operating hours, and any special comments: a good source of programs for free. Send $2 postage to the name and address above and it's yours. Sysops are encouraged to pass along information on their systems.

D/N Day Night Security System

SGM Corporation
6 West Main Street
Bound Brook, NJ 08805
(201)469-8585

Here's a plug-it-together, hardwired alarm system for those of you who worry about other users gaining unauthorized access to your computers. SGM has, it says, been making antishoplifting systems for retailers for a decade. Now it's making products available to consumers *and* retailers. Special alarm outlets on the D/N unit accept alarm cordsets from your computer and peripherals. Secured items may be handled freely as long as the cordsets are neither removed or tampered with. Optional features provide mechanical security. SGM systems start at around $50.

Black Sanctum

Mark Data Products
24001 Alicia Parkway #207
Mission Viejo, CA 92691
(714)768-1551

In Black Sanctum you'll meet the forces of black magic as you roam an eighteenth-century monastery. Not all hooded figures in the monastery are what you might expect them to be. Evil locations are visible in full hi-res detail. The 32K game costs $24.95 on tape, $27.95 on disk.

Computer Power For Your Law Office

Sybex
2344 Sixth Street
Berkeley, CA 94710
(415)848-8233

Lawyers know about law, not computers, so author Daniel Remer has written *Computer Power For Your Law Office* for those lawyers who want to make the transition from manual to automated filing systems, from typewriters to word processors, from letter openers to electronic mail, and more, including calendaring, accessing outside data bases, and buying software. The illustrated paperback costs $19.95.

The Lawyer's Microcomputer

R.P.W. Publishing Corp.
Box 1108
Lexington, SC 29072
(803)359-9941

Published twice monthly, *The Lawyer's Microcomputer* is a compendium of information about the use of TRS-80s in the legal profession. Articles on how to put those machines to the best use in offices, articles on trade shows, product reviews, and reportage of legal issues are part of the notebook-style, typewritten newsletter. The annual subscription rate is $58 in the United States, $70 in Canada and Mexico, and $94 anywhere else.

Microcomputer Software Directory

Computing Publications Inc.
Princeton-Forrestal Center
101 College Road East
Princeton, NJ 08540
(609)452-8090

Software for commercial, industrial, administrative, and educational evnironments is listed in the Microcomputer Software Directory, which lists over 3600 software packages and 1000 suppliers. Software descriptions, compatible machines, matching operating systems, memory and peripherals required, the number of users, and the date each program entered the market are part of each listing. Listings are cross-indexed by software function, hardware, name, industry, and vendor. A matrix matches operating systems and hardware. The directory is available on a 15-day money back trial basis. Its cost is $35.

Tut's Tomb

Mark Data Products
24001 Alicia Parkway #207
Mission Viejo, CA 92691
(714)768-1551

Arcade gamers have another assembly language game to play with Tut's Tomb. Gamers must guide an adventurer through the tomb of a pharaoh, outmaneuver dangerous creatures, and find the magic keys that lead to the treasure. Tut's Tomb is available on 32K cassette for $24.95, and on 32K disk for $27.95

UPS Power Systems

Bits Power Systems, Inc.
11020 Audelia Road,
Suite B114
Dallas, TX 75243

Most ancillary power systems transfer your computer from the power company's power line to battery power after an outage. The Bits systems use the power company's power only to recharge their own battery power, hence the Bits proclamation of "true uninterruptible" power supplies. Both units run on gel batteries and have visual, audible, and remote alarm functions, a battery monitor, and four standard, grounded, output receptacles. The standard full load back-up time from internal batteries is 10 minutes. External 12 volt batteries may be used for ex-

There are, after all, better ways to spend a day.

I can think of half a dozen things I'd rather do than type all day. Please send me the tapes for the months I've listed below.

ISSUE*	QTY.	PRICE	S & H EA.	TOTAL
		$9.95	$1.50	
		$9.95	$1.50	
		$9.95	$1.50	
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1-YEAR SUBSCRIPTION $99.95 (S & H INCL.)				

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Account # _____
Exp. _____
Or send check or money order

Name _____
005
Address _____
_____ Zip _____

MAIL TO:

The Color Computer Magazine Tapes
Highland Mill, Camden, ME 04843

*March & April are combined. CC Space Trek and Banner Program not included.

NOW AT LAST!

A check writing program for your color computer at an affordable price . . . save time and effort each month . . . all you do is sign the check . . . place in a "windowed" envelope . . . stamp and mail . . . it's easy.

Features:

- Menu driven
- Complete screen prompts
- Print checks from data statements
- Print checks from tape or disk input
- Print checks from keyboard input
- List checks on the screen before printing
- List checks on the screen after printing . . . with check totals
- Make check corrections
- Printed statements for records
- Special typing fonts

16K and Printer Required
Cassette Tape: $25.00 including postage & handling (make your own disk version)

APPLE VALLEY SOFTWARE CO.
P.O. Box 24274
Apple Valley, MN 55124

Minnesota residents add 6% sales tax.

☎ Enter 2 on TeleResponse page 134

ICE BIRD

100 % MACHINE LANGUAGE ARCADE ACTION

YOU ARE-a PENGUIN in a maze of ice blocks which you can push or shatter.
YOUR GOAL-connect three diamond blocks without getting stung.
YOUR STRATEGY-eliminate your pursuers by crumbling their hatching blocks or by sliding ice blocks at them as they move about the maze.

Great Graphics & Sound Effects
Over 12 Increasingly Difficult Mazes
Which Change As You Play
One or Two Player Option
Only Requires 16K & A Joystick
Cassette **$24.95** Disk **$28.95**
+$1.50 S/H In OH add 5.5% tax

CRYSTAL SOFTWARE
6591 Dawsey Road
Rock Creek, OH. 44084

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NEW:PRODUCT$

tended back-up time and automatic charging. The Model UPS-200 (200 watts) weighs 35 pounds, measures five-by-13-by-16 inches and costs $795. The Model UPS-400 (400 watts) weighs 55 pounds, measures six-by-16-by-18 inches and costs $995.

Play With Language

Radio Shack
1800 One Tandy Center
Fort Worth, TX 76102
(817)390-3300

Play With Language, from the Children's Computer Workshop series, is an early reading experience divvied up into three parts: Picture Place!, Roll-A-Word, and Bagasaurus. Picture Place! is a picture/word association exercise in which children choose a background scene, then create a picture by using words as building blocks. Roll-A-Word has them choose a word "family" and a picture from a rhyme pattern with a graphic and word generating machine. Bagasaurus sends them on a trip; students can collect words and/or images by answering (correctly, of course) various types of reading comprehension questions. The words and images are then used in blanks that have been built into familiar fairy tales and stories. Users will need 32K, Extended Color Basic, and a disk drive. Play With Language costs $99.

The Official Zaxxon

Radio Shack
1800 One Tandy Center
Fort Worth, TX 76102
(817)390-3300

The Shack has a new version of Zaxxon out, The Official Zaxxon. The cassette game puts you in the pilot's seat of a fighter spacecraft on a mission to meet and destroy the deadly Zaxxon robot. You must avoid the enemy craft, base missiles, firing emplacements, and radar towers of the mighty Space Fortress. Wham, bam. You'll need 32K, joysticks, and $34.95.

Hands On!

Radio Shack
1800 One Tandy Center
Fort Worth, TX 76102
(817)390-3300

Get the kids writing and drawing; that's the idea behind this educational program from Radio Shack's Children's Computer Workshop. One part of Hands On! is called Blackboard, which gets youngsters to use the computer as a word processor and electronic bulletin board. Stories, poems, and riddles are all part of that. In another part, called Color It, the graphics functions are explored, including tasks like changing images' colors, positions, and using horizontal and vertical scrolls. Hands On! costs $99 and requires 32K, Extended Color Basic, and a disk drive.

Educational Software Selector

Teachers College Press
Columbia University
1234 Amsterdam Avenue
New York, NY 10027
(212)678-3919

TESS, The Educational Software Selector, tells you who sells what educational software for microcomputers. Review synopses accompany the nearly 6000 listings. Listings are by subject and grade level. The 680-page paperback costs $49.95.

Programming in C

Hayden Book Company
50 Essex Street
Rochelle Park, NJ 07662
(201)368-2202

Programming in C, says Hayden, tells you everything you need to know to start doing just that. Over 90 sample programs for 16-bit micros are in this book by Steven G. Kochan. Program looping, decision-making, arrays, structures, character strings, operation of bits and other subjects are addressed. So are a summary of the lan-

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★B-5 Software★

B-5 believes your Color Computer is a unique teaching tool. Our programs have been created by teaching professionals to give your children the help they need. B5 incorporates fun with basic learning skills.

★★★★★★★★★★★★★★★★★★★★★★★★★★

EDUCATIONAL PROGRAMS

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Grades 1-4
16K Cass. $24.95; 32K Disk $26.95

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Grades 2-4
16K Cass. $19.95; 32K Disk $21.95

4★MONEY
Grades 2-4
16K Cass. $19.95; 16K Disk $21.95

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Grades 2-4
16K Cass. $19.95; 32K Disk $21.95

4★MATHFACT
Grades 1-5
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Grades 1-4
16K Cass. $16.95; 32K Disk $18.95

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Grades 1-8
16K Cass. $19.95; 32K Disk $21.95

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Grades 1-8
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Grades 1-8
16K Cass. $16.95; 32K Disk $18.95

KEYBOARD
Grades 1-8 *16K Cass. $19.95; 32K Cass. $24.95; 32K Disk $26.95*

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All B-5 programs require Extended Basic.

BROCHURES UPON REQUEST
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DATA TAPE LISTINGS

★★★★★★★★★★★★★★★★★★★★★★★★★★

Data Tapes may be used with other B5 programs.
They cannot be used alone

Use With Keyboard Program

KEYBOARD PHONIC DRILL - letter, word and sentence linger drills using common vowel and consonant combinations *$8.95*

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DOLCH WORDS - 273 words used most often in beginning readers. *$8.95*

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NOUNS AND VERBS - 4 lessons on nouns and 4 on verbs. Grades 3-5. *$8.95*

READING COMPREHENSION - lessons build from simple to complex. Grades 2-4

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Cause & Effect	*$10.95*
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1024 Bainbridge Place
Columbus, Ohio 43228
(614) 276-2752

Free Shipping in U.S.A. & Canada
(Ohio residents add 5.5% Sales Tax)

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Sugar Software **$17.95**

HELP! Help me think of the letters I need to com plete this word!

S _ G A _

GALACTIC HANGMAN

- Expand your vocabulary
- Improve your spelling
- 700 words included
- Create your own files of words
  - your child's spelling list
  - your most misspelled words
  - your child's vocabulary lists
- Great high resolution graphics
- Exciting animation
- Super sound effects
- Easily moved to disk

16K ECB and 32K ECB versions included

An educational game that makes you laugh?
Yes, I laughed so hard the tears rolled down my (part of body, plural).

Silly Syntax

Tape - $19.95
Disk (2 stories) - $24.95
Disk (all 62 stories) - $49.95

- Create hilarious stories
- Drills the parts of speech (nouns, verbs, adjectives, adverbs)
- Ideal for home or classroom use
- Great for practice reading aloud *(this is hard to do while laughing)*
- *Create your own stories with the built-in text editor*

Additional Silly Syntax Story Tapes available:

Story Tapes (10 stories per tape, **$9.95** each — Silly Syntax game required):

SS 001	Fairy Tales
SS 002	Sing Along
SS 003	X-Rated
SS 004	Current Events
SS 006	Adventure/ Science Fiction
SS 007	Potpourri

16K ECB required for tape; 32K ECB required for disk.

SUGAR SOFTWARE
2153 Leah Lane
Reynoldsburg, Ohio 43068
(614) 861-0565

Gift Certificates are available in any amount!

Add $1.00 per tape for postage and handling. Ohioans add 5.5% sales tax. COD orders are welcome. CIS orders EMAIL to 70405, 1374. Dealer inquiries invited

A complete catalog of other sweet Sugar Software products is available.

VISA MasterCard

☎ **Enter 61 on TeleResponse page 134**

THE Color Computer MAGAZINE

1-800-CALL 800
TeleResponse

TeleResponse Page

TeleResponse is here! It's a new, fast, and easy way for you to get the information you want, when you want it.

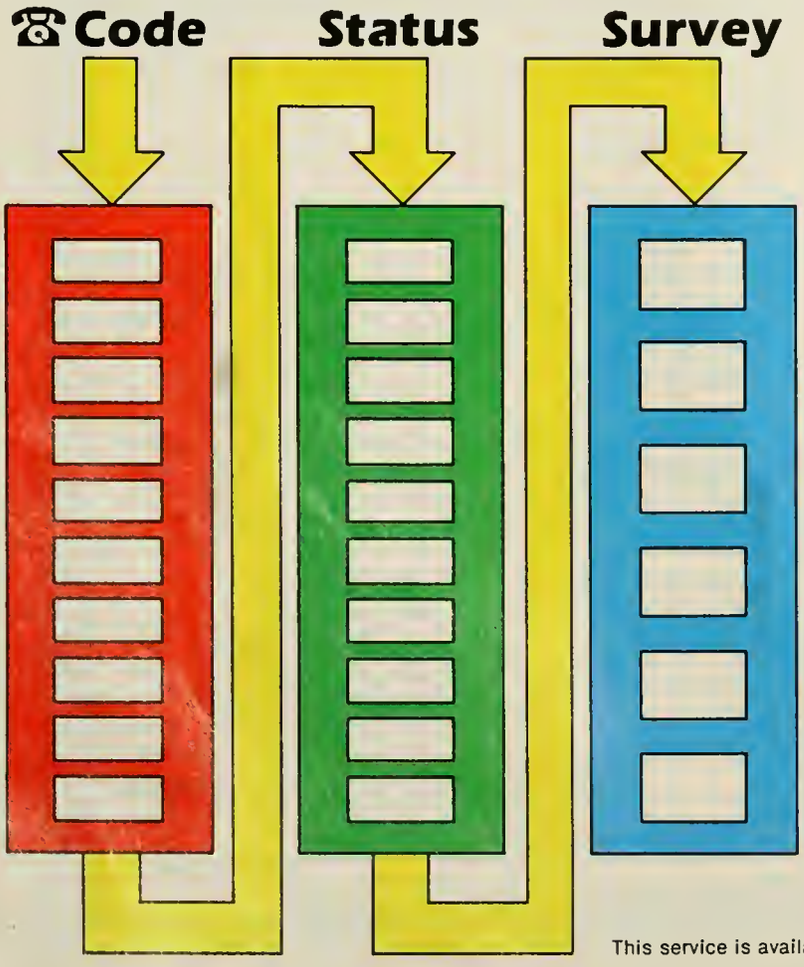
How does it work? Like the Reader Service Card of the past, when advertised products tickle your fancy, jot their numbers down in the spaces below. Then pick up your phone and dial **1-800-CALL-800.** We pick up the cost of the phone call, and your request for information is passed on to the products' manufacturers quickly and efficiently.

BEFORE you reach for the telephone:

1) Review the entire magazine for products you'd like to add to your Color Computer;
2) Enter in the **RED** shaded area below advertiser code numbers which follow the ☎ symbol near those ads which interest you
3) For *each* information packet you request, please enter in the **GREEN** shaded area *one* of the following:
   10 = I plan to purchase within 30 days
   20 = I may purchase within 6 months
   30 = I need information for my files
4) In exchange for the information you're requesting, you can provide valuable input to us and our advertisers regarding your future needs and objectives. Please take a moment now to review this month's Reader Survey. Enter your response to each question in the **BLUE** shaded area. That's all there is to it.

Now, dial toll-free **1-800-CALL-800** and go for it!

This is Issue #10-05



Reader Survey

A. What is your present system's memory capacity?
   1. 64K 2. 32K 3. 16K 4. 4K

B. Is your system configured for: 1. Color Basic
   2. Extended Color Basic 3. OS/9 4. Basic 09?

C. Do you own: 1. Disk drives 2. Printer
   3. Modem 4. Joysticks 5. Multi-pak interface
   6. Plotter 7. Light pen?

D. What do you plan to buy during the next six months?
   1. More memory 2. Upgraded ROM 3. Printer
   4. Modem 5. Disk drives 6. Multi-pak interface

E. What do you use your computer for?
   1. Adult learning tool 2. Child's learning tool
   3. Small business or home management
   4. Games 5. Programming

F. In reading **The Color Computer Magazine,** what are your major editorial interests?
   1. Educational programs
   2. Home management and small business applications
   3. Hardware projects 4. Games
   5. Telecommunications 6. Peripheral information

This service is available in the continental U.S. only. Readers in other areas may call 207-596-0501.

NEW:PRODUCT$

guage, a list of common programming mistakes, and calling sequences for many functions of the Unix standard C library. The 384-page paperback costs $18.95.

Database Directory

MacMillan Publishing Company
866 Third Avenue
New York, NY 10022
(212)702-4212

There are over 1500 databases out there, collectively perhaps the largest library ever assembled, or assemblable, as it were. The *Omni Online Database Directory*, edited by Mike Edelhart and Owen Davies, guides you through them, analyzes and evaluates them, and provides users' comments, access information, suppliers' addresses and telephone numbers, and costs. It also discusses how to pick a modem and set it up, what software you should consider, and of course which vendor best fits your needs. The directory costs $19.95 hardcover, $10.95 paperback.

Databar

Databar Corporation
10202 Crosstown Circle
Eden Prairie, MN 55344
(612)944-5700

Oscar, the acronym for Databar's optical scanning reader, is a bar code reader that saves you the trouble of typing programs into your computer. What you do is scan printed pages of bar code instead. Quick and easy. The printed pages appear in Databar, the monthly bar code software magazine, and program categories include education, money management, legal matters, health, and games. The suggested retail price for the reader and the premier issue of the magazine is $79.95. The premier issue includes eight programs. For a $120 annual membership fee Oscar owners can join the Databar Club and get a year's worth of magazines — about 100 programs.

Preschool Computing

Software Specialists
Box 2029
Princeton, NJ 08540
(609)443-6782

Even toddlers can benefit from the right kind of exposure to computers, Software Specialists believes. The firm has two programs, Early Letter Recognition and Kids' Choice, both designed to transform your television from an "electronic pacifier" to a "focus of family participation." Early Letter Recognition displays, at random, graphic renditions and/or animated displays of letters pressed on the keyboard. The Enter key never has to be used. Each letter's "show" is different and when the Z key is pressed the alphabet song is played with displays of all letters. Kid's Choice is similar but done with numbers. Graphic renditions and, at random, sets of pictures (corresponding in number to the numerals pressed) will appear. Zero is the "wild card" numeral; Software Specialists isn't telling just yet what happens when the zero is pressed. Each 16K program comes on cassette for $12.95, or you can buy them together for $19.95. They require Extended Color Basic and are modifiable.

Super Color Biorhythms

Armadillo Int'l Software
Box 7661
Austin, TX 78712
(512)835-1088

This biorhythms program is written in Basic and assembly language and graphs the applicable physical, emotional, and intellectual cycles of people, places, and things. The program accepts any input date from the year zero through 9999 AD. Even nations' rhythms can be tracked, Armadillo says, so users can "find those dates in the future that could be critical to us all." The cassette program costs $19.95 and requires 16K and Extended Basic.

Advertisers' Index

END OF FILE

Now That We Have The Child's Attention, Shall We Take The Candy Away?

We've all seen the ads in various computer and general circulation magazines. The advertisements promise a new world of information at our fingertips, if only we buy this computer or that computer, or subscribe to this information service or that information service.

A busy executive, with no time to study all the many financial newspapers, has entered the new world of electronics. She lets her micro automatically connect with one of the business information services and track her stock portfolio five times a day.

An amateur meteorologist calls up one of the consumer-oriented information services and retrieves a massive amount of weather information directly from the computers of the National Weather Service, including a full color display of the latest radar maps from around the country.

Both of these scenarios are possible, today, due to advances in information storage and distribution, as well as to the proliferation of computers among non-traditional data sources and users. Couple this with the consumer demand for information services, and the ability of businesses to market these information services at a profit, and you can see the information explosion is well on the way to becoming a "barnburner."

No longer does a computer user in the vast outreaches of the Texas panhandle have to work alone in his quest for the solution to a particular problem he's having with his computer. Through a bulletin board or time-sharing system like CompuServe or The Source, he can connect, in real time, with other users who may be having the same problem, or who have already solved that problem.

This ability of *communications*, the exchange of meaningful information between one party and another, is the root upon which information services operate today, be they the large corporate time-sharing system or a local bulletin board operating part time.

Science fiction fans will be familiar with all the advances predicted for the future. A global information network: being able to download the current edition of any newspaper in the world; being able to send and receive electronic mail on a global basis, are a few dreams of communications yet to come.

Back on Earth, though, it appeared for a while as if the bubble were about to burst, and the person holding the pin was none other than our beloved Ma Bell and the companies her deregulation spawned.

The problem began in Oklahoma last year, when Southwestern Bell Telephone Company began charging users who connected their computers to the telephone lines via a modem, an "information terminal charge" of $20 – $50, instead of the normal residential rate of $5 – $10. It didn't matter whether the modem was connected full time or not, the charges applied.

The reasoning behind extra charges for "data quality" lines was reasonable years ago, when telephone circuits were only beginning to be technically capable of coping with finicky computers that could stand little or no extra noise on the lines. The majority of data users in those days were businesses, who could easily write off the additional cash outlay for special phone lines as a cost of doing business.

Today, when a home telephone instrument can easily be used for personal part-time telecommunicating, with no extra signal processing by the phone company required (thanks to advances in both the telephone system and the circuits our present modems use), the extra charges for "data quality" lines are outmoded.

And therein lies the rub.

As long as the tariffs under which telephone companies operate permit them to tack extra charges onto an individual user's service, you can bet the telephone companies will try to collect the extra charge, even though they no longer need to do anything out of the ordinary to justify the charge. So, the obvious solution is to try to remove those tariffs from the books, right?

As this is being written, word comes that Southwestern Bell has decided to amend the tariff, the formal list of charges that the telephone company has had approved by the state regulatory agency, so that private users of modems will not be charged the higher rates.

But, the tariffs that apply to the other 49 states probably will still carry the "information terminal charge" and could be applied by the telephone operating companies almost at will, and that prospect causes us to ponder whether many of the operators of local bulletin board systems (that have sprung up in all corners of the country) could afford to continue operating their service if they also had an additional telephone charge of, say, $30 a month tacked onto their phone bill. How many of the bulletin board's users could, or would, pay the extra charge, even for occasional use of their phone lines with a personal computer?

Then apply the same reasoning to the national information networks that depend largely on consumers for their customers. We begin to wonder whether there would be many dial-up numbers left around.

The group of Oklahoma computerists that managed to have Southwestern Bell repeal their surcharge for modems proved that an organized effort can have an effect on newly-independent telephone companies. And it's now time for individual modem users and user groups to become involved in getting any similar tariffs removed from their state's telephone companies, lest they, too, find an unpleasant surprise in their phone bill. The place to fight the battle is with the individual state's regulatory commission, for they are charged with protecting the individual rights of their state's population in dealings with public service utilities such as the telephone companies.

Unless these state regulatory agencies recognize that consumer-oriented information exchange over telephone lines is much different from the business user's situation, the information explosion might fizzle out just when it looked like the world, indeed, would be at our fingertips.

— R. Wayne Day, Communications Editor

FOR...NEXT (06,84)

In the June issue we'll present some special articles that will help in small business and home finance endeavors.

We will also look in on the visit by The Gridleys to The Sorcerer and his apprentices, and enjoy a new Summer Project winner's game. We'll also present the final program needed for Kitsz's Color Burner, and Part II of Devil's Disk Editor. And that's just a beginning... see you then!

Explore the ancient, mystical tomb of the great Pharoah. Find the magical keys which lead you to unbelievable treasures as you out maneuver the creatures that slither and swarm about you. Super fast arcade action—this one will knock your socks off with 16 screens of incredible color and sound. $24.95 cassette, $27.95 disc. Requires 32K.

TIME FIGHTER

Pilot your MD-64 fighter through a hazardous time tunnel. Your mission is to destroy the dreaded Time Guardian who threatens the natural order of the universe. In order to reach this menace you must fight aerial dangers from strange and different time zones. $24.95 cassette, $27.95 disc. Requires 16K.

MD Mark Data Products

24001 Alicia Pkwy., #207, Mission Viejo, CA 92691 • (714) 768-1551

ORDERING INFORMATION Phone your order for speedy delivery Use your MastarCerd or Visa We elso eccept checks end money orders ALL ORDERS Pleese edd $2.00 shipping end handling in the continentel U S All others, edd eir shipping end $3,00 handling California residents edd 6% salas tex Foraign orders plaase remit U.S funds. Distributad in Canada by Kelly Software Distributors SOFTWARE AUTHORS Contact us for exciting marketing dateils

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AMDISK YOUR COLOR COMPUTER®

Get 312 Kbytes* of on-line, formatted storage capacity for your Color Computer with the Amdisk-III. The Amdisk-III is a disk drive system that combines the capacity and compatibility of 5¼" floppies with the convenient size and ruggedness of the state-of-the-art in technology — the 3" microfloppy cartridge.

Join the move to maximize your Color Computer's power and "Amdisk" it. Many software vendors have joined, and will be providing software on Amdek's 3" cartridge upon request. These software suppliers are: Cognitec; Computerware; Frank Hogg Laboratories; The MicroWorks; Tom Mix Software; Moreton Bay Software; Nelson Software Systems; Petrocci Freelance Associates; Prickly Pear Software; Saguaro Software; Skyline Marketing; The Software Station; Spectrum Projects; Star-Kits and Sugar Software.

*An additional 312 Kbytes may be accessed by manually flipping the media over.

®Color Computer is a registered trademark of Tandy Corporation.

Single Drive Version Available — $379.00

You can purchase the Amdisk-III from any of these fine dealers:

Computerware: (619) 436-3512
DATAMAN: (416) 529-1319
Delker Electronics: (615) 459-2636
Emerald Computer: (800) 468-4606
Saguaro Software: (602) 885-6508
Skyline Marketing: (312) 286-0762
The Software Station: (313) 532-2550
Spectrum Projects: (212) 441-2807
or ask for the Amdisk-III at your local computer dealer.

2201 Lively Blvd. • Elk Grove Village, IL 60007
(312) 364 1180 TLX 25 4786

AMDEK

REGIONAL OFFICES: Southern Calif (714) 662 3949 • Texas (817) 498-2334
Northern Calif (408) 370-9370 • Denver (303) 794 1497

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